PHILIPS

100 MHz Digital Storage Oscilloscope
PM3365/PM3367

TEST&MEASUREMENT CUSTOMER SUPPORT

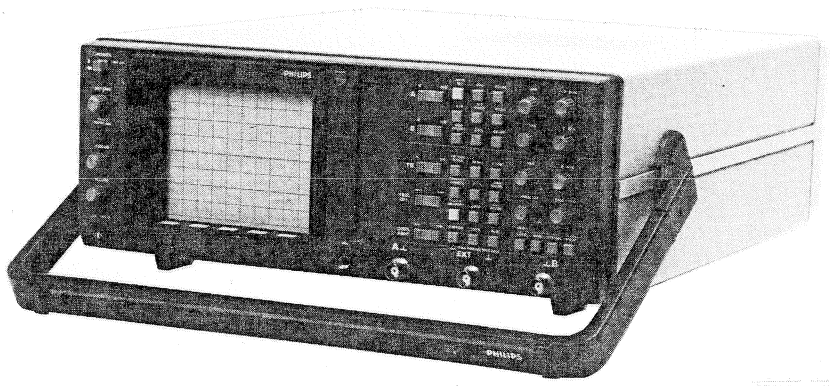
4822 872 00391
881205

Operation Guide

100 MHz Digital Storage Oscilloscope
PM3365/PM3367

Operation Guide

4822 872 00391
881205



MAT3046A

PHILIPS

PHILIPS

IMPORTANT: **In correspondence concerning this instrument please quote the typenumber and serial number as given on the type plate on the rear of the instrument.**

NOTE: The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.

© N.V. PHILIPS GLOEILAMPENFABRIEKEN - EINDHOVEN - THE NETHERLANDS 1988

PRINTED IN THE NETHERLANDS

Table of Contents

SHIPMENT NOTE ..... i - i

INITIAL INSPECTION ..... i - i

1 OPERATORS SAFETY **1 - 1**

1.1 INTRODUCTION ..... 1 - 1

1.2 SAFETY PRECAUTIONS ..... 1 - 1

1.3 CAUTION AND WARNING STATEMENTS ..... 1 - 1

1.4 SYMBOLS ..... 1 - 1

1.5 IMPAIRED SAFETY-PROTECTION ..... 1 - 2

2 INSTALLATION INSTRUCTIONS **2 - 1**

2.1 SAFETY INSTRUCTIONS ..... 2 - 1

2.1.1 EARTHING ..... 2 - 1

2.1.2 MAINS VOLTAGE CORD AND FUSES ..... 2 - 1

2.2 MEMORY BACK-UP ..... 2 - 2

2.3 HANDLE ADJUSTMENT AND OPERATING POSITIONS ..... 2 - 3

2.4 RACKMOUNT VERSION ..... 2 - 3

3 OPERATING INSTRUCTIONS **3 - 1**

3.1 GETTING STARTED ..... 3 - 1

3.2 FRONTPANEL LAY OUT AND OPERATION ..... 3 - 2

3.2.1 FRONTPANEL LAY OUT ..... 3 - 2

3.2.2 SCREEN CONTROLS ..... 3 - 2

3.2.3 VIEWING AREA ..... 3 - 3

3.2.4 UP-DOWN KEYS ..... 3 - 4
3.2.5 FUNCTION KEYS ..... 3 - 5
3.2.6 ROTARY KNOBS ..... 3 - 8
3.2.7 SOFTKEYS ..... 3 - 8
3.2.8 INPUTS AND OUTPUTS ..... 3 - 10

4 APPLICATIONS **4 - 1**

4.1 USE AS AN ANALOG OSCILLOSCOPE ..... 4 - 1
4.1.1. VERTICAL MODE ..... 4 - 2
4.1.2. HORIZONTAL MODE ..... 4 - 8
4.1.3. TRIGGER MODE ..... 4 - 10

4.2 USE AS A DIGITAL STORAGE OSCILLOSCOPE ..... 4 - 18
4.2.1. VERTICAL MODE ..... 4 - 18
4.2.2. HORIZONTAL MODE ..... 4 - 22
4.2.3. TRIGGER MODE ..... 4 - 26

4.3 CURSOR MEASUREMENTS ..... 4 - 32
4.3.1 AMPLITUDE MEASUREMENTS ..... 4 - 38
4.3.2 TIME MEASUREMENTS ..... 4 - 42
4.3.3 ZOOM AND AUTO ZOOM FUNCTIONS ..... 4 - 46

5 PLOTTING AND PRINTING **5 - 1**

5.1 INTRODUCTION ..... 5 - 1

5.2 ANALOG PLOT OUT TO XY RECORDERS. ..... 5 - 2

5.3 PLOT AND PRINT VIA IEEE-488 INTERFACE ..... 5 - 4

5.4 PLOT AND PRINT VIA RS-232C INTERFACE ..... 5 - 6

5.5 PLOTTING OR PRINTING RESULTS ..... 5 - 9

6 APPLICATION PRESELECT MENU **6 - 1**

6.1 INTRODUCTION ..... 6 - 1

6.2 ANALOG PLOT ..... 6 - 1

6.3 DIGITAL PLOT ..... 6 - 1

6.4 PRINT ..... 6 - 2

6.5 SINGLE SHOT ..... 6 - 2

6.6 TV TRIGGERING AFTER AUTO SET ..... 6 - 2

6.7 IEEE-488 (optional) ..... 6 - 2

6.8 RS-232C (optional) ..... 6 - 2

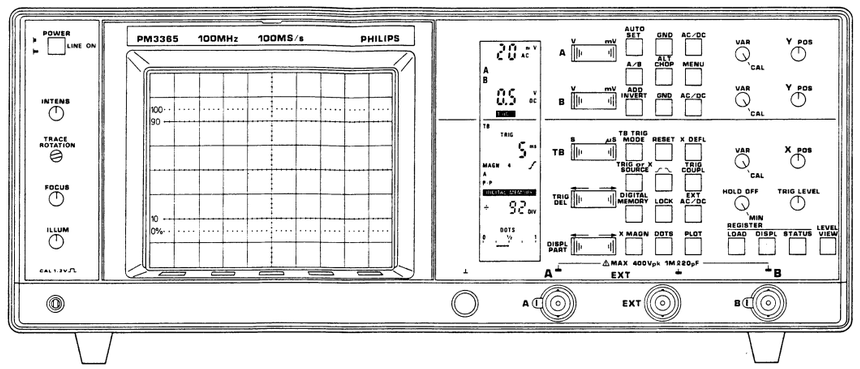
Thank you for purchasing this Philips oscilloscope. It has been designed and manufactured to the highest quality standards to give you many years of trouble free and accurate measurements.
The powerful measuring functions listed below have been combined with an easy logical operation to let you use the full power of this instrument each and every day.

Should you have any comments on how this product could be improved then please contact your local Fluke/Philips organisation.

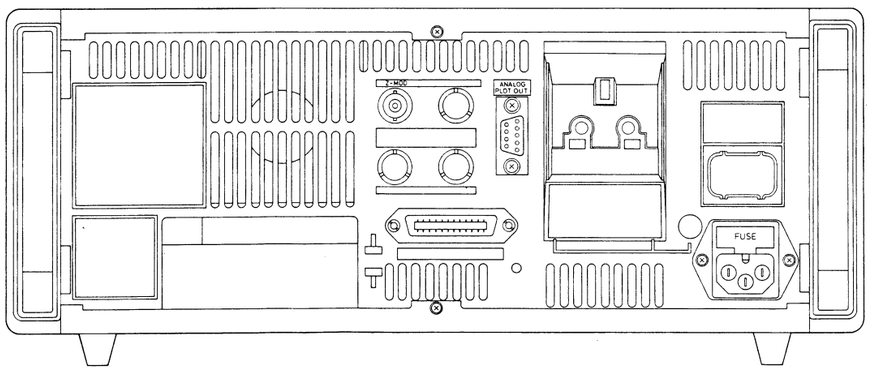
PM 3365/PM 3367 Main Capabilities

- 100 MHz analog and digital oscilloscope
- 100 Msample/s single shot digital acquisition on both channels
- Auto Set for instant signal viewing in both analog and digital oscilloscope modes
- Cursors for time and amplitude measurements in digital oscilloscope mode
- Reference memories and non-volatile storage of all waveforms
- Optional interface facilities for remote control and hard copy output

FRONT VIEW OF OSCILLOSCOPE



REAR VIEW OF OSCILLOSCOPE



FRONT PANEL CONNECTORS

	CAL	Amplitude calibrated output socket
		Measuring earth socket.
	A	BNC input socket for channel A with probe indication
	EXT	BNC input socket channel EXTERNAL
	B	BNC input socket for channel B with probe indication

REAR PANEL CONNECTORS

	Z-MOD	Input socket for Z-modulation of the CRT trace.
	ANALOG PLOT OUT	Plot output socket to connect the oscilloscope to an analog XY plotter
FUSE	LINE IN	Mains input socket including fuse holder.

OPTIONAL REAR PANEL CONNECTORS

	IEEE BUS OPTION	Input/output socket to connect the oscilloscope to a IEEE 488/IEC 625 interface.
	OR	
	RS232 BUS OPTION	Input/output socket to connect the oscilloscope to a RS-232C/V24 interface.

SHIPMENT NOTE

The following parts should be included in the shipment:

- 1 OSCILLOSCOPE
- 2 BATTERIES
- 1 FRONT COVER
- 1 OPERATION GUIDE or
- 1 BEDIENUNGSANLEITUNG or
- 1 NOTICE D'UTILISATION
- 1 MAINS VOLTAGE CORD
- 2 PROBES
- 1 REFERENCE MANUAL

INITIAL INSPECTION

Check the contents of the shipment for completeness and note whether any damage has occurred during transport. If the contents are incomplete, or there is damage, a claim should be filed with the carrier immediately, and the Philips/Fluke Sales or Service organisation should be notified in order to facilitate the repair or replacement of the instrument.

This page intentionally left blank

1 OPERATORS SAFETY

ATTENTION: Read this page carefully before installation and use of the instrument.

1.1 INTRODUCTION

The instrument described in this manual is designed to be used by properly-trained personel only. Adjustment, maintenance and repair of the exposed equipment shall be carried out only by qualified personnel.

1.2 SAFETY PRECAUTIONS

For the correct and safe use of this instrument it is essential that both operating and servicing personnel follow generally-accepted safety procedures in addition to the safety precautions specified in this manual. Specific warning and caution statements, where they apply, will be found throughout the manual. Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

1.3 CAUTION AND WARNING STATEMENTS

CAUTION: Is used to indicate correct operating or maintenance procedures in order to prevent damage to or destruction of the equipment or other property.

WARNING: Calls attention to a potential danger that requires correct procedures or practices in order to prevent personal injury.

1.4 SYMBOLS

Read the operating instructions.

Protective earth (grounding) terminal (black)

1.5 IMPAIRED SAFETY-PROTECTION

Whenever it is likely that safety-protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation. The matter should then be referred to qualified technicians. Safety protection is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

2 INSTALLATION INSTRUCTIONS

ATTENTION: You are strongly advised to read this chapter thoroughly before installing your oscilloscope.

2.1 SAFETY INSTRUCTIONS

2.1.1 EARTHING

Before any connection to the inputs is made, the instrument must be connected to protective earth via the three-core mains cable. The mains plug must be inserted only into a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without protective conductor.

WARNING: Any interruption of the protective conductor inside or outside the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.

When an instrument is brought from a cold into a warm environment, condensation may cause a hazardous condition. Therefore, make sure that the earthing requirements are strictly adhered to.

2.1.2 MAINS VOLTAGE CORD AND FUSES

Different power cords are available for the various local mains voltage outlets. The power cord version delivered is determined by the particular instrument version ordered.

NOTE: If the mains plug has to be adapted to the local situation, such adaptation should be done only by a qualified technician.

This oscilloscope has a tapless switched-mode power supply that covers most nominal voltage ranges in use:
AC voltages from 100 V...240 V (r.m.s.).
This obviates the need to adapt to the local mains voltage. The nominal mains frequency range is 50 Hz...400 Hz.

WARNING: The instrument shall be disconnected from all voltage sources when renewing a fuse.

Mains fuse rating: 1,6 A delayed-action, 250 V.

The mains fuseholder is located on the rear panel in the mains input socket. If the mains fuse needs replacing, proceed as follows:
- disconnect the instrument from the mains.
- remove the cover of the fuseholder by means of a screwdriver.
- fit a new fuse of the correct rating and refit the cover of the fuseholder.

WARNING: Make sure that only fuses of the required current and voltage rating, and of the specified type, are used for renewal. The use of the repaired fuses, and/or short-circuiting of the fuseholder, is prohibited.

2.2 MEMORY BACK-UP

This instrument is provided with a built-in memory back-up circuit if batteries are fitted. Upon power down front settings are stored when in the analog mode of use or the front settings and traces are stored when in the digital mode of use. The oscilloscope returns to these settings on power on. This memory function works when the oscilloscope is switched off from the front panel or when the mains supply is interrupted more then 20 ms.

The memory back-up batteries (2*LR6 Alkaline Penlight) placement and replacement must be carried out only by a qualified technician.

Replacing the batteries:

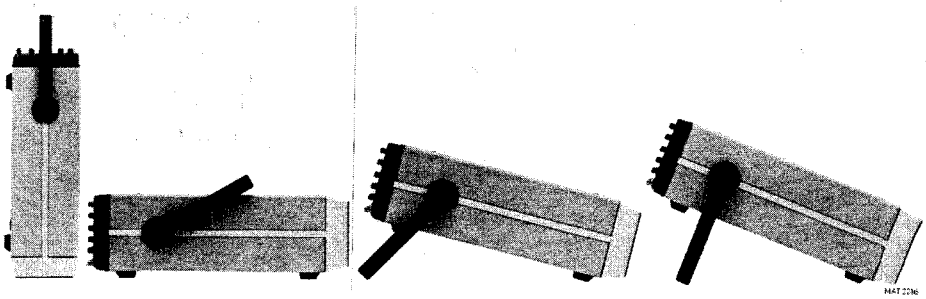
- The instrument must be disconnected from the mains.
- Remove the screw that holds the top cover at the rear of the instrument.
- Gently push the cover backwards until it can be lifted.
- Remove the cover by lifting it clear of the instrument. The memory battery back-up unit is now accessible. This unit is located on the instrument's rear panel.
- Ease off the clip that holds the memory back up unit to the chassis.
- Gently slide the battery holder out of the chassis.
- Install both batteries in their holders. The installation direction of the batteries is shown on the battery holder.

NOTE: When replacing the memory back-up unit, take care not to damage the wiring in the vicinity of the battery holder.

2.3 HANDLE ADJUSTMENT AND OPERATING POSITIONS

By pulling both handle ends outwards away from the instrument the handle can be rotated to allow the following instrument positions:

- vertically on its rear feet;
- horizontally on its bottom feet;
- in two sloping positions on the handle.



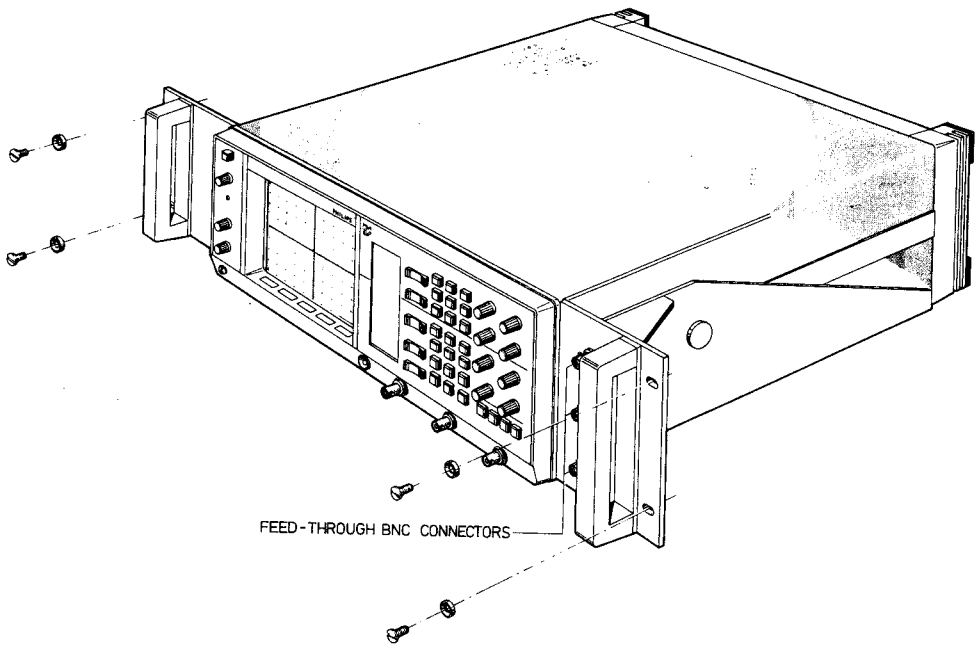
ATTENTION: Do not position the oscilloscope on any surface which radiates heat, or in direct sunlight.
Ensure that the ventilation holes at the rear and top are free from obstruction.

2.4 RACKMOUNT VERSION

The PM3367 is provided with a rackmount cabinet without handle. This offers the possibility to build the instrument into a standard 19 inch rack.

The PM3367 is delivered with spacers and screws (4 *European type and 4 * American type).

ATTENTION: To maintain adequate instrument cooling, all ventilation holes of the cabinet above and behind must remain free of obstructions by at least 2 cm.



2.4 RACKMOUNT VERSION

3 OPERATING INSTRUCTIONS

3.1 GETTING STARTED

- Connect the oscilloscope to the mains voltage.
- Switch the oscilloscope on by means of the push-button POWER LINE ON.
- Adjust the TRACE ROTATION by means of a screwdriver so that the trace is parallel with the horizontal graticule lines.
- Connect a probe to input A of the oscilloscope.
- Connect the other end of the probe to the CAL output of the oscilloscope.
- Press the AUTO SET key.

The AUTO SET function will set automatically all relevant parameters of the oscilloscope (attenuator setting, time base setting and trigger source setting) for an optimum trace.

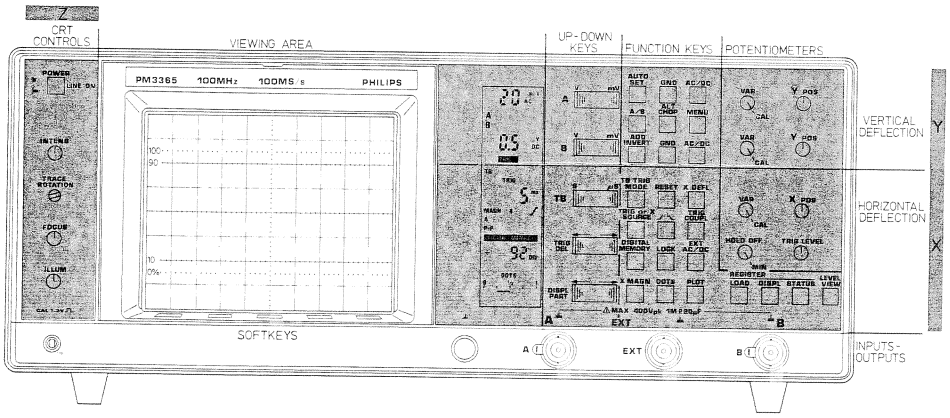
If the probe you use is an attenuator probe 10:1 or 100:1 then you may have to adjust it for the correct compensation, according to the probe instructions.

3.2 FRONTPANEL LAY OUT AND OPERATION

3.2.1 FRONTPANEL LAY OUT

The frontpanel is designed with optimum ergonomic and logical lay-out of the controls: from left to right and from top to bottom, like reading a book. For ease of access to the oscilloscope the front panel is divided into seven main areas.

- Screen controls
- Viewing area (screen + LCD)
- Up-down keys
- Function keys
- Rotary knobs
- Softkeys
- Inputs and outputs



3.2.2 SCREEN CONTROLS

After switch-on with the POWER LINE ON push button, the screen controls can be adjusted for optimum illumination, trace and spot quality.

The trace and text intensity is set by the INTENS rotary knob, and a sharp display is obtained by the FOCUS rotary knob.

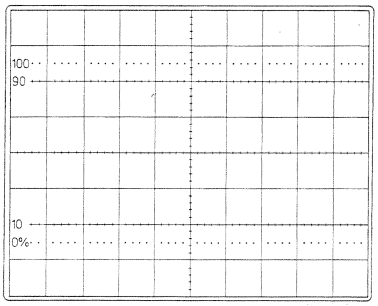
The screw driver control TRACE ROTATION is used to set a grounded trace parallel with the horizontal graticule lines.

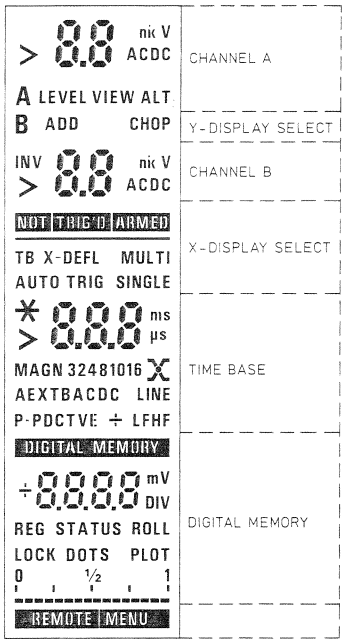
The graticule of the screen can be lit-up by the ILLUMINATION rotary knob, this can be used in dark environment or for making photographs.

3.2.3 VIEWING AREA

The viewing area consists of the screen of the Cathode Ray Tube (CRT) and a Liquid Crystal Display (LCD).

The CRT screen is divided in a 10 * 8 divisions area. Each division contains five sub-divisions. On the left side of the CRT screen four lines are marked with the values 100% 90% 10% and 0%. These marked lines can be used for percentage measurements or rise time measurements.





The LCD indicates all the selected active functions, settings and parameters.
Its layout is logically divided into areas according to the keys and knobs.

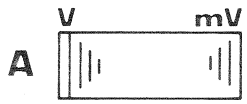
A flashing segment indicates:

- an incorrect selection of knobs/keys controls,
- a VAR rotary knob in uncal position,
- the end of a UP-DOWN control range,
- a key has been operated during the PLOT action,
- the DISPL PART UP-DOWN key has been pressed in TB MAGN *1 mode.

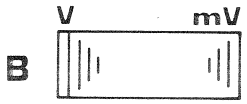
3.2.4 UP-DOWN KEYS

The UP-DOWN key selects the required setting out of the range of settings possible for that function.
They are used for the attenuator setting, the time base setting, the trigger delay setting and the display part setting.

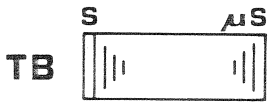
RANGES OF UP-DOWN KEYS



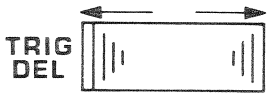
VERTICAL ATTENUATOR SETTING CHANNEL A
Selection of vertical attenuation of channel A
Analog: 2 mV/div ... 10 V/div in 1-2-5 sequence
Digital: 2 mV/div ... 10 V/div in 1-2-5 sequence



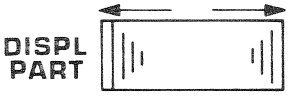
VERTICAL ATTENUATOR SETTING CHANNEL B
Selection of vertical attenuation of channel B
Analog: 2 mV/div ... 10 V/div in 1-2-5 sequence
Digital: 2 mV/div ... 10 V/div in 1-2-5 sequence



HORIZONTAL TIME-BASE SETTING
Selection of time-base speed
Analog: 0,5 s/div ... 50 ns/div in 1-2-5 sequence
Digital: 50 s/div ... 20 ns/div in 1-2-5 sequence



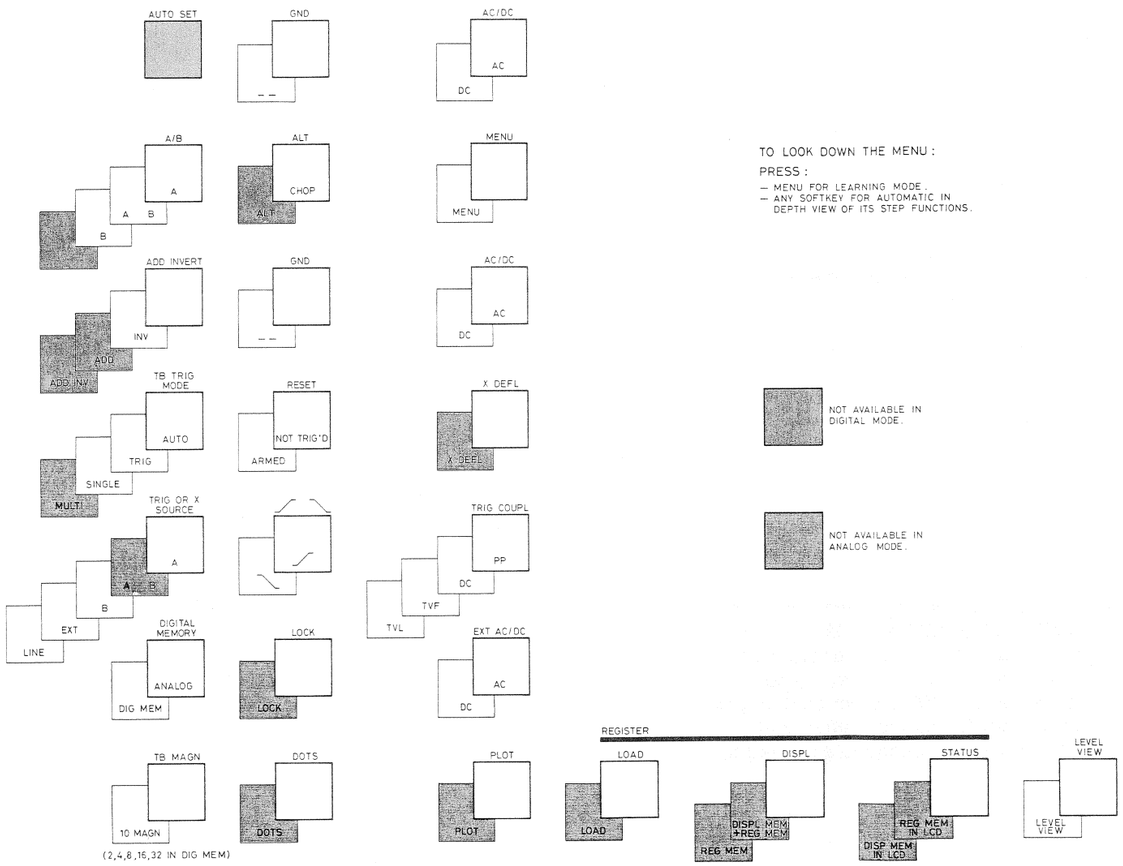
TRIGGER DELAY SETTING
Selection of trigger delay
Analog: not available
Digital: -10 div... +2500 div in 1 div sequence
(in TB = 50 s/div...0,5 µs/div)
0 div... +20 div in 1 div sequence
(in TB = 0,2 µs/div...20 ns/div)



DISPLAY PART SETTING
Selection of the displayed part of a magnified trace
Analog: not available
Digital: 1/16 ... 16/16 sequence depending on TB MAGNIFY value.

3.2.5 FUNCTION KEYS

This oscilloscope features the possibility to select several functions with a single key in sequential order. To obtain the correct function it is necessary to press the particular key repeatedly until the correct function is visible in the LCD. After the last function in line, the sequence starts again. An overview of the functions is given below:



TO LOOK DOWN THE MENU :

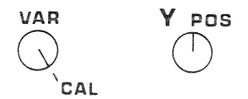
PRESS :

- MENU FOR LEARNING MODE.
- ANY SOFTKEY FOR AUTOMATIC IN DEPTH VIEW OF ITS STEP FUNCTIONS.

3.2 FRONTPANEL LAY OUT AND OPERATION

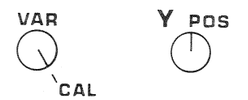
3.2.6 ROTARY KNOBS

With the ROTARY knobs, contiuously-variable adjustment of the function is obtained. ROTARY knobs are available for the functions:



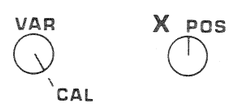
Y POS
Vertical screen position channel A

VAR A
Variable attenuation channel A



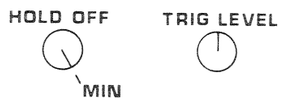
Y POS
Vertical screen position channel B

VAR B
Variable attenuation channel B



X POS
Horizontal screen position time-base

VAR
Variable time-base (not in DIGITAL MEMORY)

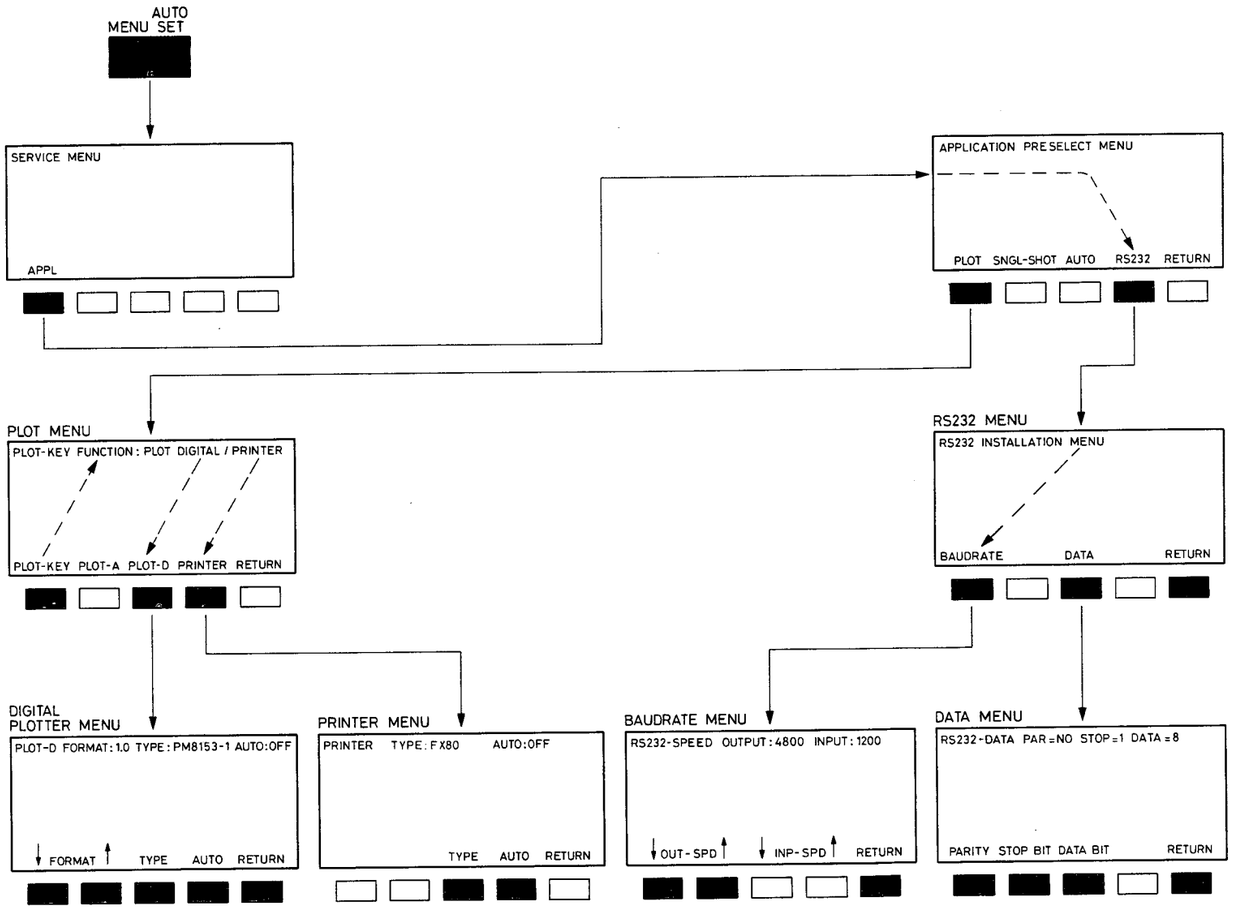


TRIG LEVEL
Trigger level

HOLD OFF
Hold off time

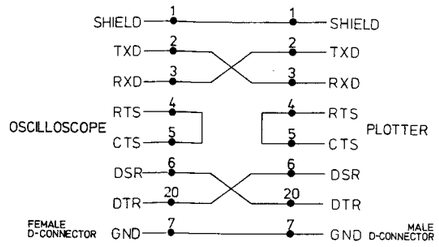
3.2.7 SOFTKEYS

The five softkeys located below the CRT can be used for different functions in digital memory mode, e.g. AMPLITUDE CALCULATIONS, TIME CALCULATIONS and the ZOOM facility. All calculation and manipulation facilities are activated via successive steps through the softkey menu structure. When the menu has been activated, the CRT screen contains two area's for text. The top text area shows all calculation information and channel settings and the bottom text area shows all functions assigned to the five softkeys.

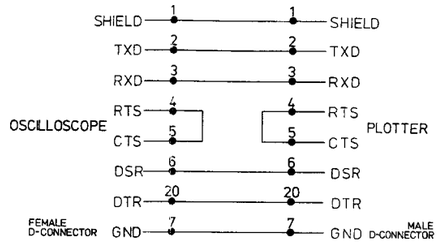


5.4 PLOT AND PRINT VIA RS-232C INTERFACE

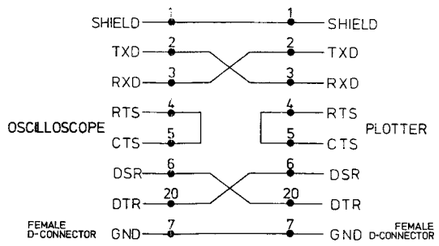
Cable configuration for the XY plotters PM8153-1, PM8153-6, PM8155, HP7475A, FX80 compatible dot matrix printers and HP-Thinkjet printer.

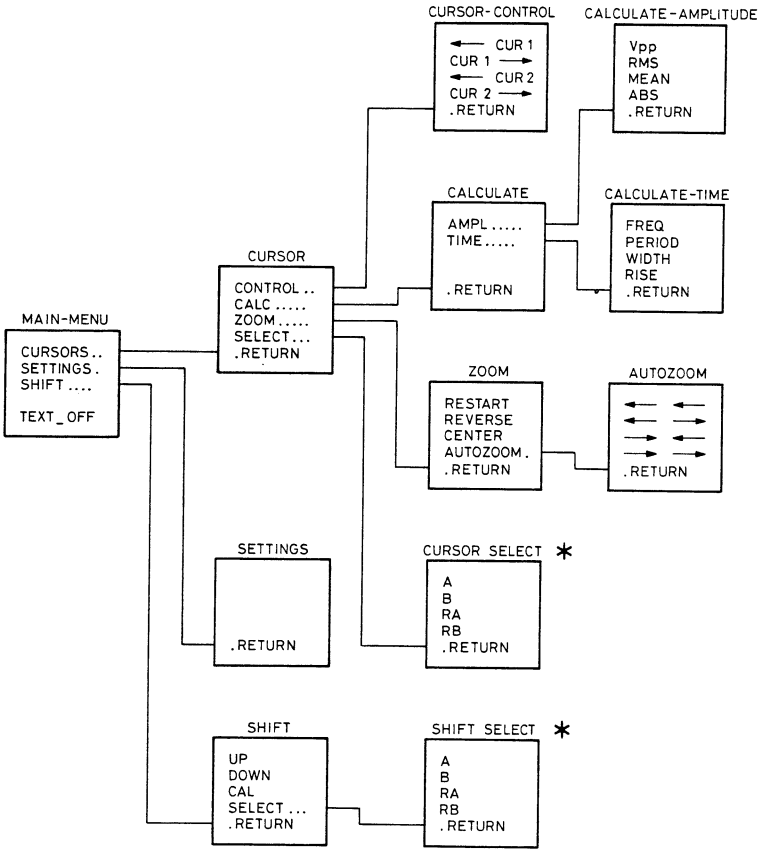


Cable configuration for the XY plotter PM8154.



Cable configuration for the XY plotter HP7550.





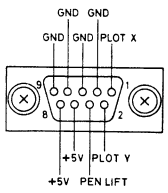
* ONLY ACTIVE IF MORE THAN ONE CHANNEL IS DISPLAYED

3.2.8 INPUTS AND OUTPUTS

In addition to the measuring inputs A, EXT and B, the oscilloscope is equipped with several inputs and outputs to provide special functions and applications.
All standard and optional sockets are described below:

3.2.8.1 Standard

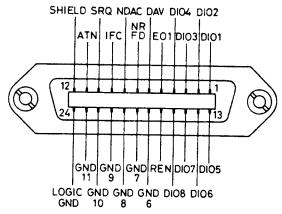
SOCKET	DESCRIPTION
A	BNC input socket for channel A. Probe range indicator identifies attenuation of probe connected and this is compensated for in the LCD display for vertical deflection.
B	BNC input socket for channel B. Probe range indicator identifies attenuation of probe connected and this is compensated for in the LCD display for vertical deflection.
EXT	BNC input socket; When EXT input is selected via the time-base the signal input is used for external triggering. When EXT input socket is selected via X DEFL, the horizontal deflection is determined by the signal applied to this socket.
CAL	Output socket providing a 1,2 V(p-p), 2 kHz approx. square-wave voltage. To be used for probe compensation or to calibrate the vertical deflection AMPL. control.
LINE IN	Input socket for mains supply: 100 V...240 V(ac), 45 Hz...440 Hz
ANALOG PLOT OUT	Output socket providing the plot signals Y PLOT, X PLOT and PENLIFT. Penlift can be defined in "APPL" application preselect (see chapter 7). Sensitivity PLOT X and PLOT Y: 100 mV/div Penlift: open collector



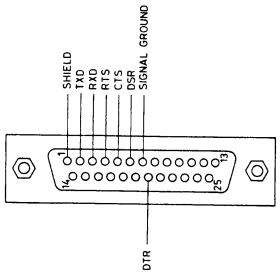
Z-MOD Input socket for Z-modulation of the CRT trace. The trace is blanked when this input is "high" (> +2,5 V). Input voltage range: 0 V... +12 V.

3.2.8.2 Optional

SOCKET	DESCRIPTION
IEEE 488 BUS	Input/output connector to connect the oscilloscope to an IEEE 488/IEC 625 interface.


SHIELD SRQ NDAC DAV DIO4 DIO2
ATN IFC NRFD EOI DIO3 DIO1
12
24
1
13
GND 11 GND 9 GND 7 REN DIO7 DIO5
LOGIC GND GND 10 GND 8 GND 6 DIO8 DIO6

RS-232C BUS Input/output connector to connect the oscilloscope to a RS-232 C/V 24 interface.



This page intentionally left blank

4 APPLICATIONS

4.1 USE AS AN ANALOG OSCILLOSCOPE

To use the instrument as an analog oscilloscope three main functions need first to be defined:

- Vertical mode
- Horizontal mode
- Trigger mode

First ensure the oscilloscope is operating in the analog mode (DIGITAL MEMORY indication in LCD is off), otherwise press the DIGITAL MEMORY key.
By pressing the AUTO SET key, the oscilloscope will automatically set the main functions to a near optimal setting. Further adjustments and selections can then be made by operating the various keys and knobs.

4.1.1. VERTICAL MODE

In vertical mode the following adjustments can be made:

- **Vertical display mode selection**
  by operating the A/B key.

Select the channel you want to see A, B or A and B simultaneously. If the ADD function is in use, it is possible to switch off the channels A and B (see page 4.7).

- **Adjustment of the absolute zero level**
  by using the GND key and the Y POS rotary knob the zero level can be positioned anywhere on the screen.

By pressing the GND key the input signal is interrupted and the input signal path is grounded. With the Y POS rotary knob the zero level can be adjusted to any level on the screen. By pressing the GND key once again the signal is once more connected to the input.

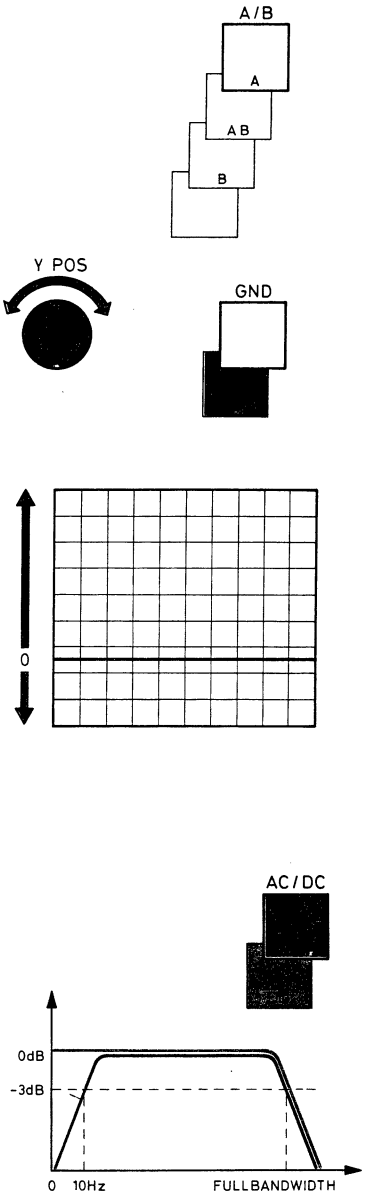
The zero level adjustment is neccesary for all DC measurements.

- **Channel coupling**
  by the AC/DC key.

In AC position the DC component of the measuring signal is rejected.
In DC position the full bandwidth is available.

AC coupling is used when a small AC signal has to be measured that is superimposed on a large DC voltage.

For example, noise measurements on power supply voltages.



4.1 USE AS AN ANALOG OSCILLOSCOPE

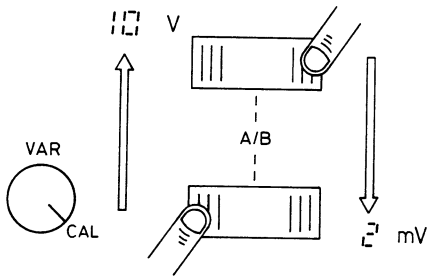
- **Vertical amplitude adjustment**
  by operating the V...mV UP-DOWN key for best setting.

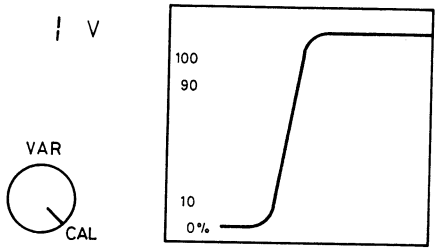
  The setting can be chosen out of a range from 2 mV up to 10 V per division in a fixed 1-2-5 sequence.

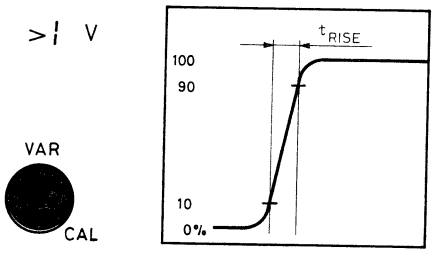
- Vertical variable attenuation
  by adjusting the VAR rotary knob.

The UNCAL position is used when the measurement is taken in percentages (UNCAL indication " > " flashes in the LCD), with the rotary knob the measured signal can be set to 100 %

For example rise-time measurements are made between 10 % and 90 % of a waveforms edge. If a measured square-wave signal has a peak-peak value of 6,2 divisions it can be attenuated to 5,0 divisions (= 100%) by adjusting the VAR rotary knob. As 5 divisions is now 100 %, the 10 % and the 90 % levels and the time between these levels can easily be read from the screen.







4.1 USE AS AN ANALOG OSCILLOSCOPE

- **Selection of ALTERNATED or CHOPPED display**
  by using the ALT/CHOP key

This selection is used if two signals are displayed.

In alternate mode, the CRT beam alternately traces one signal sweep and then the other. At low repetition rates this can be seen, so ALT is mainly used for high speed time-base settings (from around 0,1 ms/div and above).

In chop mode, the beam chops from one signal to the other at a fast switching frequency and is therefore suitable for low speed signals.

- **Selection of ADD, NORMAL or INVERTED display**
  by the ADD/INVERT key.

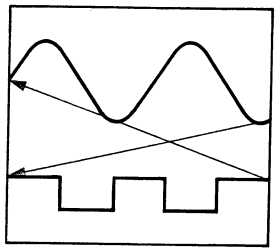
"INVERT" is active on channel B.

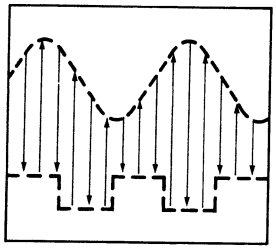
In the ADD mode, channel B is added to channel A (A + B).

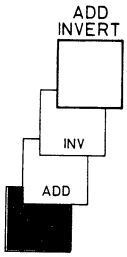
In the ADD INVERT mode, channel B is subtracted from channel A (A-B).

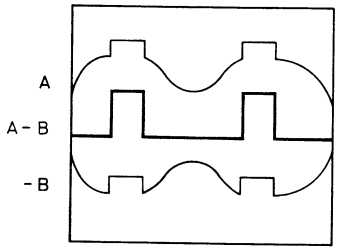
The differential mode (A-B) is useful for rejecting common-mode signals. By measuring in differential mode, the commmon-mode signal on one channel cancels out the common-mode signal on the other channel leaving the actual signal visible on the display.

A practicle application of the differential mode is to eliminate hum from a signal.









4.1 USE AS AN ANALOG OSCILLOSCOPE

4.1.2. HORIZONTAL MODE

In horizontal mode the following selections can be made:

- **Selection of X deflection or horizontal time-base**
  by the X DEFL key.

In the X deflection mode the oscilloscope shows one signal to be displayed as a function of another signal (X-Y graph).
The required X-axis signal is selected by the TRIG OR X SOURCE key (A, B, EXT or LINE).

The X-Y mode has a wide range of applications, for example:

- amplitude vs frequency of circuits and filters;
- output current vs input voltage of semiconductors;
- comparison of frequency or phase shift using Lissajous figures.

In horizontal time-base mode the display shows the measured signal vs time (Y-t graph). The time coefficient can be selected with the TB s...μs UP-DOWN key.

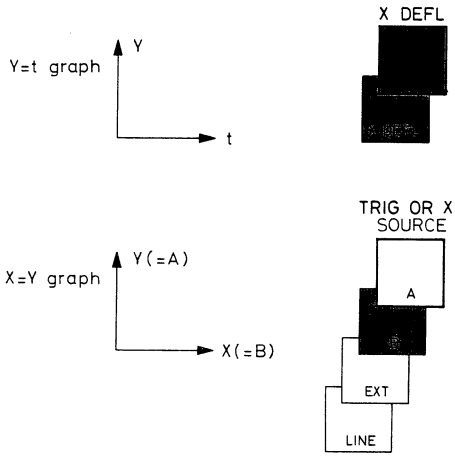
- **Selection of horizontal time scale**
  by the TB s...μs UP-DOWN key,
  the VAR rotary knob, or
  the TB MAGN key.

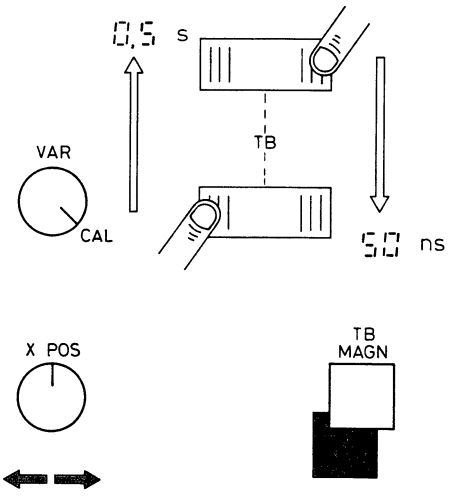
With the TB s...μs UP-DOWN key you can make a selection of the time-base speed in a 1-2-5 sequence.

With the rotary knob VAR you can make fine adjustments between the 1-2-5 steps.

With the TB MAGN you can expand the time-base 10 times.

By operating the X POS rotary knob the trace can be shifted across the screen in a horizontal direction.





4.1 USE AS AN ANALOG OSCILLOSCOPE

4.1.3. TRIGGER MODE

In trigger mode the following selections can be made:

- **Time-base trigger mode**
  by the TB TRIG MODE key.

The time base can operate in three modes:

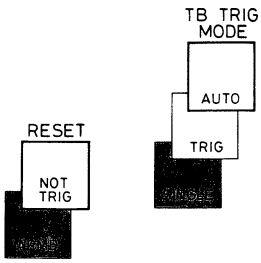
AUTO	the horizontal sweep normally starts when a trigger occurs. If no trigger is detected within 100 ms after the last sweep then a sweep start automatically occurs. This means a trace is always visible on the display.
TRIG	horizontal sweep will only start on a trigger pulse derived from the selected trigger source.
SINGLE	horizontal sweep runs only once after it is armed by the RESET key and the receipt of a trigger pulse derived from the selected trigger source.The mode is very useful to capture single events.

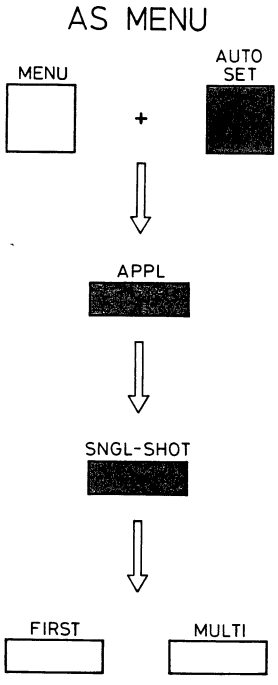
If the display mode is ALT (alternate), a special selection of single shot can be made in the application preselect menu (APPL),

- enter the APPL menu by pressing MENU and AUTO SET simultaneously,
- select the CRT softkey APPL,
- select the CRT softkey SNGL_SHOT,
- select the CRT softkey FIRST or MULTI

FIRST =	single shot is always done on channel A (provided this channel is active).
MULTI =	single shot alternates between A, B and ADD (provided these functions are active).

Leave the application preselect menu again by pressing the AUTO SET key.





4.1 USE AS AN ANALOG OSCILLOSCOPE

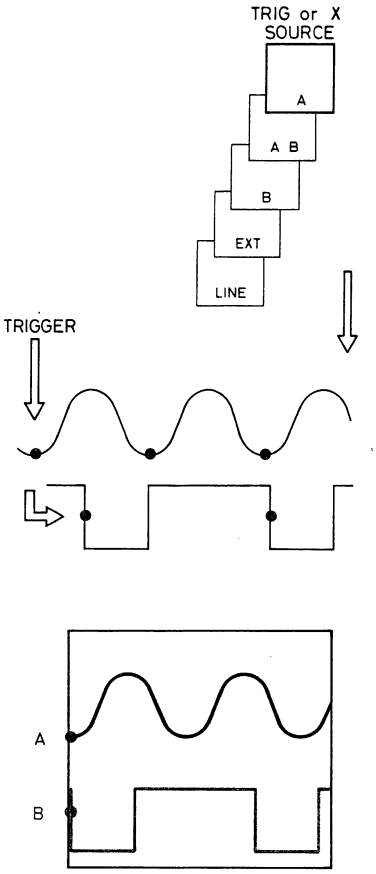
- **Trigger source selection**
  by the TRIG OR X SOURCE key.

The trigger sources can be selected from:

A	channel A
A B	composite channel A and channel B
B	channel B
EXT	channel EXTERNAL
LINE	50 Hz or 60 Hz sine-wave derived from the line voltage.

In composite triggering (A B) the trigger source alternates between A and B, therefore this trigger mode is only possible in the alternated display mode. Notice that in this mode the displayed traces are NOT time related while the trigger pulses indicate different time moments. An example of composite triggering is shown on the next page.

Line triggering is used where signals have to be measured that are time related to the LINE frequency; e.g. measurements of hum.


TRIG or X
SOURCE
A
A B
B
EXT
LINE
TRIGGER

A
B

- **Trigger level**
  by adjusting the TRIG LEVEL rotary knob.

For repetitive signals, a stable, jitter-free display will only be obtained if each time-base sweep is triggered at precisely the same point on the signal waveform. The trigger level is adjusted with the TRIG LEVEL rotary knob.

- **Trigger coupling**
  by the TRIG COUPL key.

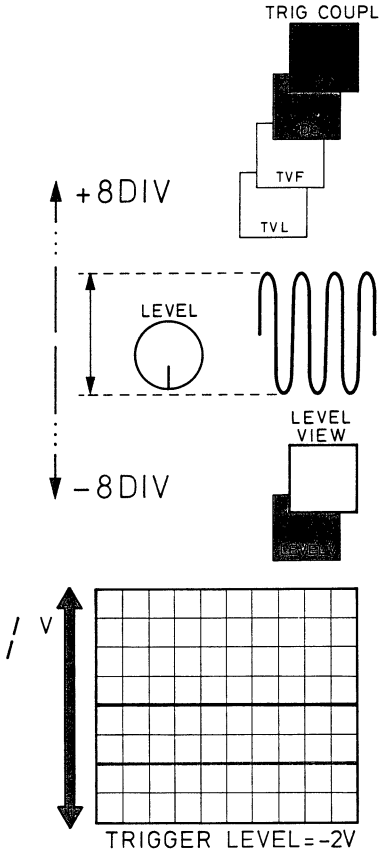
Four modes can be selected for trigger coupling:

P-P	Peak-to-peak triggering gives automatic ranging of the LEVEL knob, the ranging being determined by the peak-to-peak value of the signal. DC signals are rejected.
DC	DC triggering; the full bandwidth of the trigger channel is available, while the level range of the rotary knob is more than ± 8 divisions.

In this mode, the trigger level can also be shown with the LEVEL VIEW key. By pressing the LEVEL VIEW key, the trigger level will be shown as a DC voltage, related to the vertical mid of the oscilloscope screen. After adjusting the LEVEL rotary knob press the LEVEL VIEW knob again to return to the original screen.

TVF	TV frame triggering allows triggering at the slow TV frame (field) synchronisation pulses; the LEVEL rotary knob is inoperative.
TVL	TV line triggering allows triggering at the fast TV line synchronising pulses; the LEVEL rotary knob is inoperative.

TRIG LEVEL


TRIG COUPL
TVF
TVL
+8DIV
LEVEL
LEVEL VIEW
-8DIV
V
TRIGGER LEVEL=-2V

- **Trigger slope selection**
  by the ⎍⎏ key.

For triggering on a positive-going slope select⎍, for triggering on a negative-going slope select⎏.

If trigger coupling TVF or TFL is selected, LCD indicates + and - instead of ⎍ and⎏.
  + = positive video,
  – = negative video.

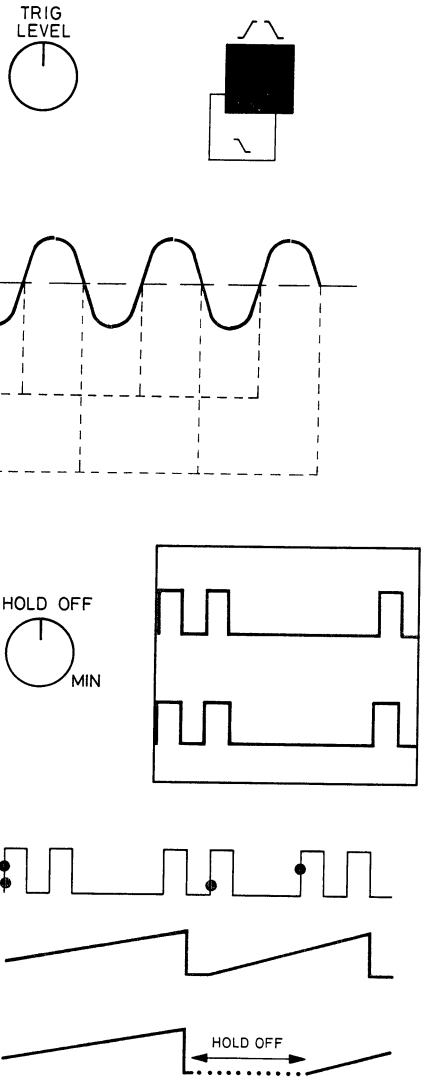
If horizontal mode X DEFL is selected, LCD indicates + and - instead of ⎍ and⎏.
  + = signal not inverted,
  – = signal inverted.

- **Hold-off time**
  by the HOLD-OFF rotary knob.

The HOLD-OFF rotary knob is used to prevent "false" triggering and "double writing" when examining multiple pulse signals. After the horizontal sweep is completed triggering is inhibited for period of time set by the HOLD-OFF knob. Adjustment of the HOLD-OFF enables triggering to be synchronized on the same pulse in the pulse train and so gives a stable display.

For example, consider a double pulse repetitive input signal. The selected trigger signal sees the same condition on the second pulse as the first pulse, and so the time base sweep starts too soon. The double-writing effect is seen as an extended base-line on the upper trace.

Adjusting the hold-off time will inhibit the trigger unit until it sees the first pulse again.



4.1 USE AS AN ANALOG OSCILLOSCOPE

4.2 USE AS A DIGITAL STORAGE OSCILLOSCOPE

To use the instrument as a digital storage oscilloscope three main functions should be defined:

- Vertical mode
- Horizontal mode
- Trigger mode

First ensure the oscilloscope is operating in the digital mode (DIGITAL MEMORY indication in LCD is on), if not then press the key DIGITAL MEMORY.

By pressing the AUTO SET key the oscilloscope will automatically set the main functions y to the most convenient setting.

Further adjustments should be made by operating the keys. In DIGITAL MEMORY mode there are more available than in the analog mode. The use of the identical functions is described in Section 4.1 "Use as an Analog Oscilloscope".

The analog functions which are not available in DIGITAL MEMORY mode are: ADD, ALT/CHOP, X DEFL, COMP TRIG, X VAR.

In this section only the DIGITAL functions are described.

4.2.1. VERTICAL MODE

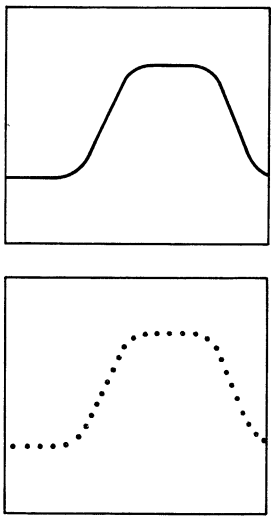
In vertical mode the following additional choices can be made:

- **Dotted or joined display**
  by pressing the DOTS key.

In digital memory mode the traces are built-up by "dots" of samples. Selection of "dotted" or interpolated (dotjoined) display can be made.

In dotjoined mode the dots are interconnected by a line, so the display appears continuous.

In dotted mode every dot is displayed separately. The vertical resolution is 256 dot positions over 10 divisions, the horizontal display resolution is 1000 dot positions over 10 divisions when the expansion factor is x1.



4.2 USE AS A DIGITAL STORAGE OSCILLOSCOPE

- **Loading of register memory**
  by pressing the register LOAD key.

The oscilloscope has two memories:

- a display memory, which you see in normal operation, and a register memory, which is used to store reference wave forms.

If you want to store a wave form in the register, simply press the LOAD key. The wave form is now stored into the register. Provided the oscilloscope is equipped with a battery back-up, all wave forms are still stored after power down for recall at the next power up..

- **Display of register memory**
  by pressing the DISPLAY key.

Pressing the DISPLAY key once will show the contents of the display memory and the register memory together on the screen. Now the two signals can be compared with each other.

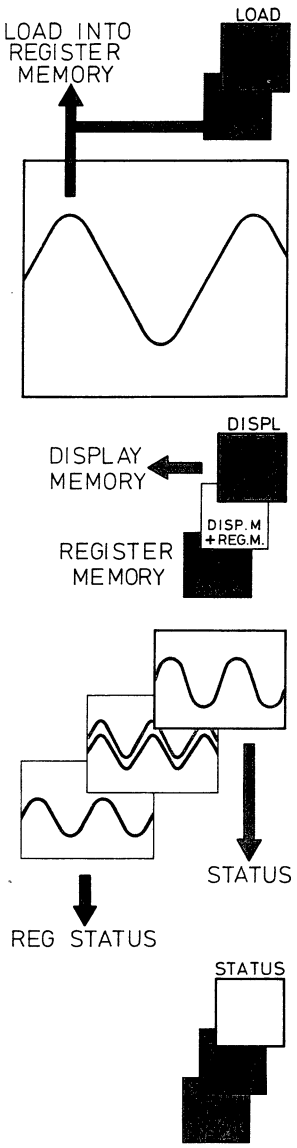
Pressing the DISPLAY key a second time will show only the contents of the register memory.

Pressing the DISPLAY key a third time will result in displaying the contents of the display memory again.

- **Status of register memory**
  by pressing the STATUS key.

Pressing the STATUS key once enables the LCD to show the full settings of the register memory.

Pressing the STATUS key twice within one second, the LCD will show the complete settings of the display memory.


LOAD
LOAD INTO
REGISTER
MEMORY
DISPL
DISPLAY
MEMORY
DISP. M
+REG.M.
REGISTER
MEMORY
STATUS
REG STATUS
STATUS

4.2.2. HORIZONTAL MODE

In horizontal mode the following selections can be made:

- **Selection of horizontal time scale**
  by the TB s...μs UP-DOWN key,
  the TB MAGN key.

The adjacent figure shows the time-base ranges in relation to the sample rate and resolution. Only in SAMPLING mode repetitive signals are needed (see also page 4.25).

The digital time-base has three modes:

ROLL
50 s/div...1 s/div

In ROLL mode the screen build-up is from right to left.

RECURRENT
0,5 s/div...0,5 μs/div

In RECURRENT mode the screen build-up is from left to right.

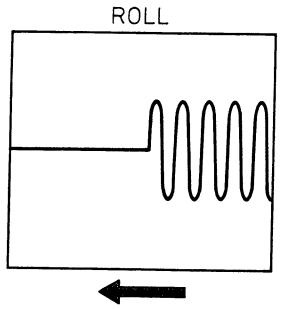
SAMPLING
0,2 μs/div...20 ns/div

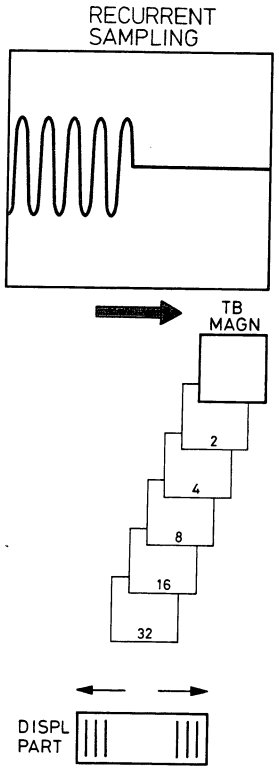
In SAMPLING mode repetitive signals are needed for a screen build-up from left to right.

By pressing the TB MAGN key, a horizontal magnification of 2, 4, 8, 16, or 32 times can be obtained. Any part of interest in a magnified signal may be selected for display by the DISPL PART UP-DOWN key.

By operating the DISPL PART UP-DOWN key, the displayed waveform will scroll across the screen in the selected direction.

The LCD bar shows the actual position of the displayed part of the magnified signal in relationship to the memory length.


ROLL


RECURRENT
SAMPLING
TB
MAGN
2
4
8
16
32
DISPL
PART

0
½
1

ROLL

Lower frequency signals, such as reference voltage drift in an amplifier over periods of several hours, can now be captured and stored in the memory. The signal is built up point-by-point at the right-hand side of the screen and moves to the left. The ROLL segment on the LCD indicates that the ROLL mode is operative.
The ROLL mode is usually started with the release of the RESET knob, but is also started when changing the triggering or amplitude control.

The TRIGGER DELAY defines the amount of the stored signal in the memory before and after the trigger. As an example: if the TRIGGER DELAY is set to -3 DIV, the trigger point will be displayed on the fourth vertical graticule line.

The following TRIGGER MODE conditions can be applied:

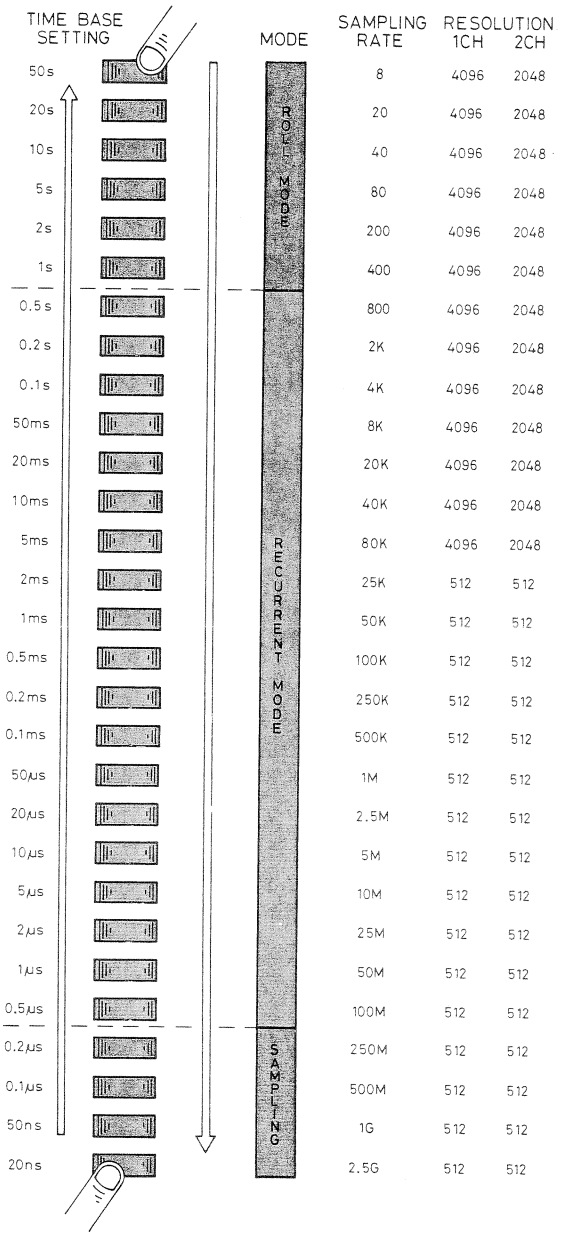
- AUTO — The stop condition of the ROLL mode in auto trigger is not the trigger level crossing point, but that point in time where the ROLL mode was first activated.
- TRIG — The stop condition is now defined by the actual trigger point, so trigger source, trigger coupling, slope and level become valid. After receiving the trigger pulse, the acquisition is then copied to the DISPLAY MEMORY.
- SINGLE — In this case the single shot acts identical to the TRIGGER mode.
- MULTI — The principle of operation is also identical to the TRIGGER mode. The first acquisition is copied to the REGISTER MEMORY, the second acquisition is copied to the DISPLAY MEMORY (see also page 4-28).

ATTENTION: Take note that the lower transition point of the bandwidth for TRIGGER COUPLING P-P is limited to 20 Hz. So the peak-to-peak is not applicable for the ROLL mode. The trigger coupling should be set to DC.

SAMPLING

Higher frequency signals can now be captured up to the full bandwidth of the oscilloscope, provided that the signal consists of repetitive and identical pulses. With sequential sampling, one point along the waveform is sampled per sweep until enough points are acquired by the DISPLAY MEMORY. The number of sweeps needed to capture a signal will therefore depend on the number of points required to fill the MEMORY.

ATTENTION: Because of the fixed time relationship between sample and trigger point, sequential sampling is NOT suitable for showing fast edges of short widely-spaced pulses.



4.2 USE AS A DIGITAL STORAGE OSCILLOSCOPE

4.2.3. TRIGGER MODE

In DIGITAL trigger mode the following extra functions are available:

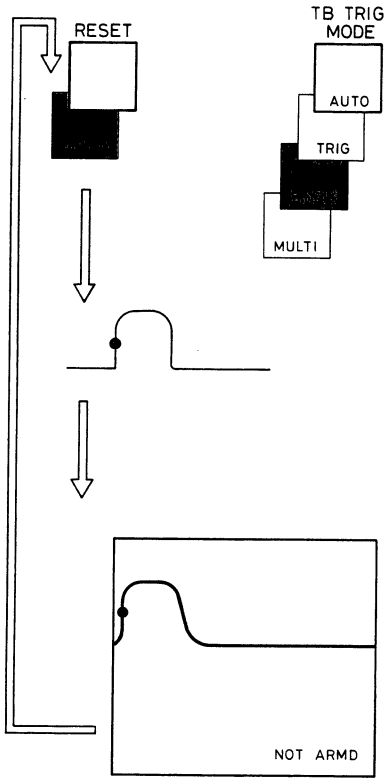
- **SINGLE SHOT**
  by pressing the TB TRIG MODE key and the RESET key.

In DIGITAL MEMORY mode the DISPLAY MEMORY content is refreshed once after a suitable trigger is received.

To clear the display memory contents press the RESET key, and the display memory contents are then set to a value at the vertical mid screen position. If the RESET key is pressed for longer than 2 seconds the display memory contents are set to the value 0 and cannot be seen on the screen. This prevents burning in of the screen.

After a RESET operation the time-base is ARMED and waits for a trigger. For a good trigger, the trigger level must be set to the desired value and the LEVEL VIEW function as described in Section 4.1 (trigger mode - trigger coupling) can be of help.

The single-shot mode is very useful to capture the signal that occurs only once. The signal is then stored in the DISPLAY MEMORY.



4.2 USE AS A DIGITAL STORAGE OSCILLOSCOPE

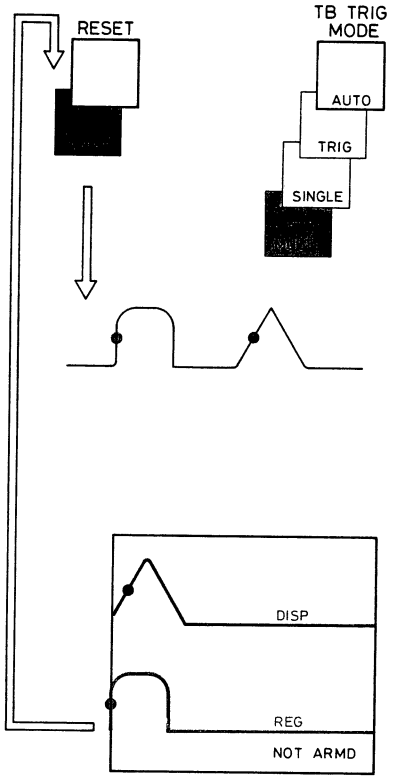
- **MULTIPLE SHOT**
  by pressing the TB TRIG MODE key and the RESET key.

In DIGITAL MEMORY mode the REGISTER MEMORY contents are refreshed ONCE after the FIRST trigger is received, and the DISPLAY MEMORY contents are refreshed ONCE after the SECOND trigger is received.

To CLEAR the contents of the MEMORIES , see SINGLE SHOT.

After a reset operation the time base is ARMED and waits for TWO new triggers.

NOTE: In this mode the content of the REGISTER MEMORY is overwritten.



4.2 USE AS A DIGITAL STORAGE OSCILLOSCOPE

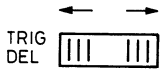
- **TRIGGER DELAY SETTING**
  by pressing the TRIG DEL UP-DOWN key.

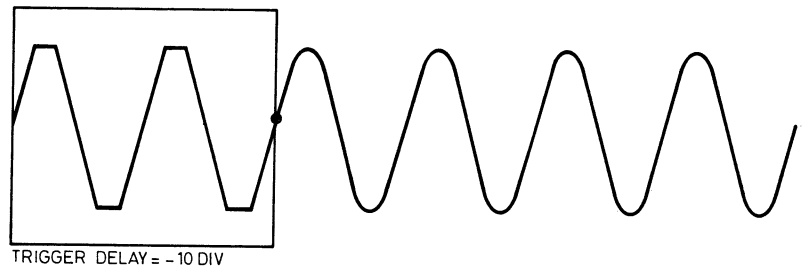
The TRIGGER DELAY setting offers PRE- and POST triggering.

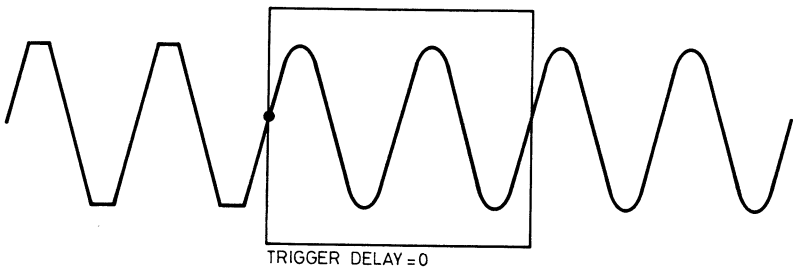
In PRE triggering you can look BEFORE the trigger point. For example, if trigger delay = -10 divisions, the trigger point is at the far RIGHT vertical graticule line. What you see is then the signal BEFORE the trigger point. This mode enables observation of events leading up to the trigger; e.g. to pin-point the cause of a problem, for instance, a mains transient.

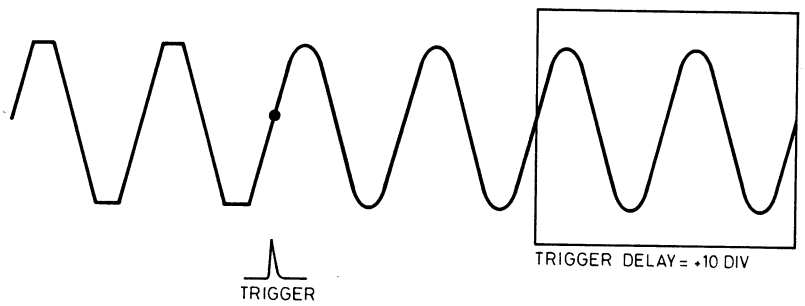
In trigger delay = 0 divisions the trigger point is at the LEFT vertical graticule line.

In POST triggering you can look AFTER the trigger point. For example, if trigger delay = +10 divisions, the trigger point is one full screen LEFT of the screen that you see.
This mode effectively stretches the memory capacity and is for example very useful when measuring a certain line in a TV pattern.


TRIG
DEL


TRIGGER DELAY = – 10 DIV

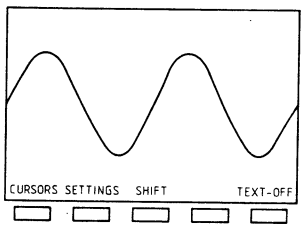

TRIGGER DELAY = 0


TRIGGER DELAY = +10 DIV
TRIGGER

4.3 CURSOR MEASUREMENTS

The following text explains the function of each menu within the softkey menu structure. The softkey function RETURN can be found in many menus and if activated it will result in a return to the previous level in the menu structure. The CRT screen contains two areas for text, the top text area shows all calculation information and channel settings, the bottom text area shows all functions selections assigned to the five softkeys.

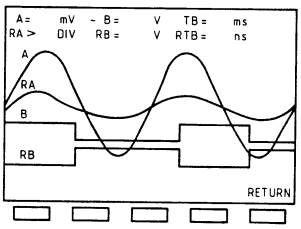
MAIN MENU



This menu is mainly used to activate the extensive CURSORS menu. Other possible selections are:

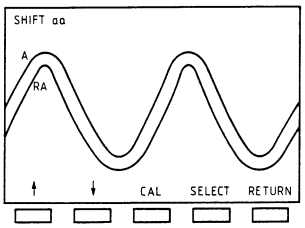
- SETTINGS. When active, this menu displays the vertical and time base settings relating to the displayed traces.
- SHIFT. Via this menu the displayed traces can be positioned vertically on the screen.

SETTINGS menu



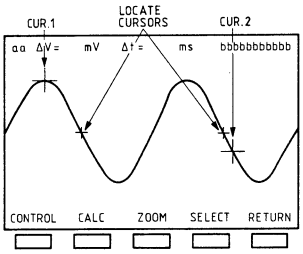
This menu shows all vertical and horizontal setting information of the active signals and the stored and displayed signals in the top text area of the CRT screen. This is very useful for making a hard copy on a plotter or printer.

SHIFT menu



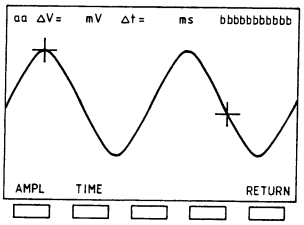
In this menu a displayed trace can be positioned UPwards or DOWNwards on the screen. If CAL is pressed the trace returns to its original position. The SELECT menu permits selection of the trace to be positioned. This menu is only active if more than one trace is visible on the screen. Correct positioning of trace A and B is only possible in LOCK mode as this is a post acquisition facility useful for overlaying single shot signals where the normal position controls can not be used.

CURSOR menu



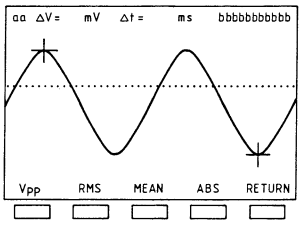
Once activated two cross-shaped MAIN CURSORS are positioned on the waveform. Via the CONTROL menu the two MAIN CURSORS can be separately positioned horizontally on the waveform. Positioning to the left and to the right is possible. CURsor 1 and CURsor 2 can not pass each other to avoid arronous negative time. Depending on previous measurement selections either a horizontal dotted line or two so-called LOCATE cursors may also be visible. The dotted line serves as a ground reference point for certain AMPlitude measurements. The small LOCATE cursors are placed on the waveform inbetween the MAIN cursors. Their position is used to indicate exactly where on the waveform the selected automatic measurement is being calculated. The result of the cursor measurements are shown on the top text line.

CALCULATE menu



A pre-selection of either AMPLitude or TIME measurements is made via this menu. The following explanation gives details of each measurement possibility.

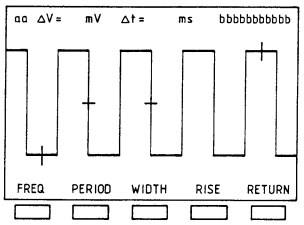
CALCULATE-AMPLITUDE menu



The following selections can be made:

- Vpp calculates the peak to peak value of the signal part between the MAIN CURSORS. The LOCATE CURSORS indicate the signal top and bottom the calculation is related. The calculation result is displayed in the top text area of the CRT.
- RMS calculates the Root Mean Square value of the waveform between the MAIN cursors. This value is referenced to the dotted ground line. This line can be vertically positioned by grounding (GND key) the relevant channel and then adjusting (Y POS) the line to the desired vertical position. The calculation will start again when the GND is released.
- MEAN calculates the mean value of the waveform between the MAIN cursors. This value is referenced to the dotted ground line. This line can be positioned in the screen as explained under the RMS mode.
- ABSolute calculates the vertical voltage differences between the dotted ground line and MAIN Cursor 1 (C1 value) and MAIN Cursor 2 (C2 value). The results are displayed in the top text area of the CRT. The reference line can be positioned across the screen as explained under the RMS mode.

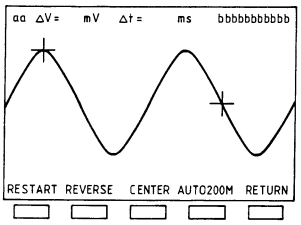
CALCULATE-TIME menu



The following selections can be made:

- FREQuency calculates the signal frequency provided that at least one signal period is present between the MAIN cursors. Only one cycle is used in the calculation, this is the nearest to the left cursor. The LOCATE cursors indicate the signal period over which the calculation is made.
- PERIOD calculates the duration of one signal period provided that at least one signal period is present between the MAIN cursors. Only one cycle is used in the calculation, this is the nearest to the left cursor. The LOCATE cursors indicate the signal period over which the calculation is made.
- WIDTH calculates the width of the first pulse seen from the left cursor provided that there is at least one pulse present between the MAIN cursors. The LOCATE cursors indicate the signal part over which the calculation is made. The pulse may be negative- or positive-going.
- RISE calculates the rise- or fall-time of the first signal slope seen from the left cursor provided that there is at least one slope between the MAIN cursors. The 100% level is taken to be the vertical value between the MAIN cursors. The LOCATE cursors indicate the part of the slope over which the calculation is made. The rise time is automatically calculated between the 10% and 90% level of the dV-amplitude or to the nearest sample to these points.

ZOOM menu



This menu is used to magnify a part of the signal while the sample resolution stays unchanged. This is only possible if the instrument is out of the LOCK mode because a new signal acquisition is necessary with adapted TBase and TRIG DELay setting. The possible softkey selections are:

- RESTART expands the part of the waveform between the MAIN cursors. This part can then be examined in more detail.
- REVERSE resets the instrument to the situation immediately before the RESTART command and then resamples the signal.
- CENTER replaces the MAIN cursors horizontally to +2 div and -2 div of the screen centre after which the RESTART can be used again.
- AUTOZOOM accesses the menu where the cursors can be shifted both to the left, away from each other, towards each other or both to the right. When shifting the cursors an automatic RESTART is made when the time between the cursors is suitable for another TBase and/or TRIG DEL setting to be used.

4.3.1 AMPLITUDE MEASUREMENTS

Vpp **Peak-to-peak voltage**

The Vpp amplitude measurement is calculated over the signal lying between the MAIN CURSORS. It is necessary to set the main cursors on the required part of the signal, using the CURSOR-SELECT menu, and the signal part using the CURSOR-CONTROL menu.

By activating the Vpp calculation function, the oscilloscope will automatically measure the peak-to-peak voltage, and will show the measuring points by two small LOCATE CURSORS.

The measuring result is shown in the top text area. If the VAR rotary knob of the channel is in CAL position, the result will be displayed in Volts. If the VAR rotary knob is in UNCAL position, the result will be displayed in Divisions:

Vpp : Vpp = ... mV, or Vpp = ... DIV

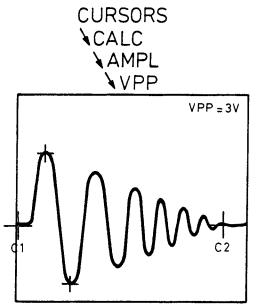
ABS **Absolute**

The ABS amplitude measurement will be calculated from the MAIN CURSORS related to the absolute zero level. This zero level is indicated as a horizontal dotted line and is related to the grounded Y position. The correct way to use this function is:

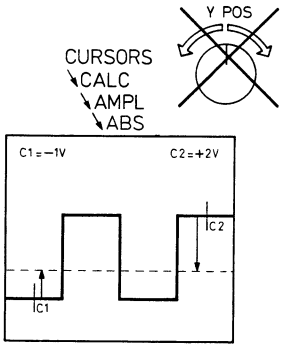
- activate the ABS function (**don't** re-adjust the Y POS rotary knob anymore,
- ground the trace and adjust the zero level anywhere on the screen,
- press the GND key once again (the signal is now connected to the channel).

The measuring result is shown in the top text area. If the VAR rotary knob of the channel is in CAL position, the result will be displayed in Volts. If the VAR rotary knob is in UNCAL position, the result will be displayed in Divisions:

ABS : C1 = ... mV, C2 = ... mV, or C1 = .. DIV, C2 = .. DIV



- MAIN CURSORS
- LOCATE CURSORS



4.3 CURSOR MEASUREMENTS

RMS **Root mean square voltage**

The RMS measurement is calculated between the MAIN CURSORS and related to the absolute zero level. This zero level is indicated as a horizontal dotted line and is related to the grounded Y position. The correct way to use this function is:

- activate the RMS function,
- ground the trace and adjust the zero level anywhere on the screen by means of the Y POS rotary knob,
- press the GND key once again (the signal is now connected to the channel). **Don't** re-adjust the Y POS rotary knob anymore.

The measuring result is shown in the top text area.

If the VAR rotary knob of the channel is in CAL position, the result will be displayed in Volts. If the VAR rotary knob is in UNCAL position, the result will be displayed in Divisions:

RMS : RMS = ... mV, or RMS = ... DIV

MEAN **Mean voltage**

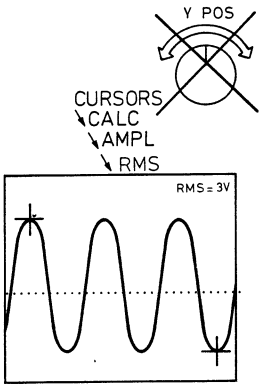
The MEAN measurement is calculated between the MAIN CURSORS and related to the absolute zero level. This zero level is indicated as a horizontal dotted line and is related to the grounded Y position. The correct way to use this function is:

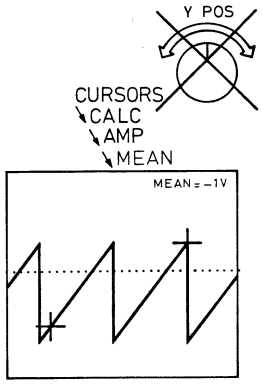
- activate the MEAN function,
- ground the trace and adjust the zero level anywhere on the screen by means of the Y POS rotary knob,
- press the GND key once again (the signal is now connected to the channel). **Don't** re-adjust the Y POS rotary knob anymore.

The measuring result is shown in the top text area.

If the VAR rotary knob of the channel is in CAL position, the result will be displayed in Volts. If the VAR rotary knob is in UNCAL position, the result will be displayed in Divisions:

MEAN: MEAN = ... mV, or MEAN = ... DIV





4.3 CURSOR MEASUREMENTS

4.3.2 TIME MEASUREMENTS

FREQ Frequency

The FREQ measurement is calculated between the MAIN CURSORS. It is necessary to set the main cursors on the signal, using the CURSOR-SELECT menu, and the signal part using the CURSOR-CONTROL menu (see also Section 3.2.7).

By activating the FREQ calculation function the oscilloscope will automatically measure the period time of the signal and will show the measuring points by two small LOCATE CURSORS. Minimal one signal period should be covered by the MAIN CURSORS.

The measuring result is shown in the top text area.

FREQ : f = ... kHz

PERIOD Period

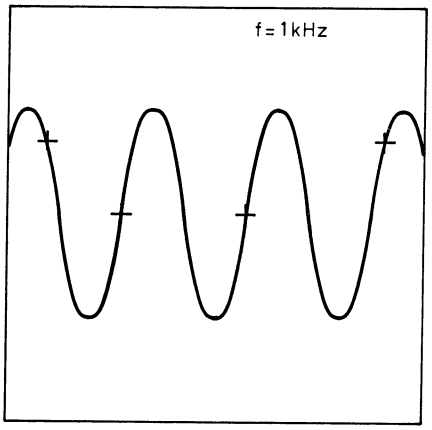
The PERIOD measurement is calculated between the MAIN CURSORS. It is necessary to set the main cursors on the signal, using the CURSOR-SELECT menu, and the signal part using the CURSOR-CONTROL menu (see also Section 3.2.7).

By activating the PERIOD calculation function the oscilloscope will automatically measure the period time of the signal and will show the measuring points by two small LOCATE CURSORS. Minimal one signal period should be covered by the MAIN CURSORS.

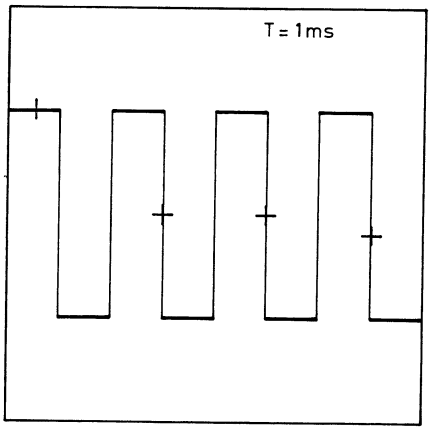
The measuring result is shown in the top text area.

PERIOD : T = ... s

CURSORS
↘ CALC
↘ TIME
↘ FREQ



CURSORS
↘ CALC
↘ TIME
↘ PERIOD



WIDTH Pulse width

The WIDTH measurement is calculated between the MAIN CURSORS. It is necessary to set the main cursors on the signal, using the CURSOR-SELECT menu, and the signal part using the CURSOR-CONTROL menu (see also Section 3.2.7).

By activating the WIDTH calculation function the oscilloscope will automatically measure the pulse width of the first pulse seen from the left cursor. The pulse width is determined on the half peak-to-peak amplitude between the MAIN CURSORS.

The measuring result is shown in the top text area.

WIDTH : tw = ... s

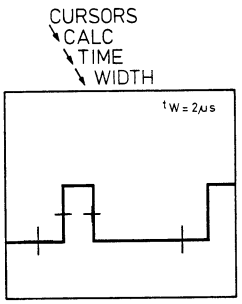
RISE Rise time

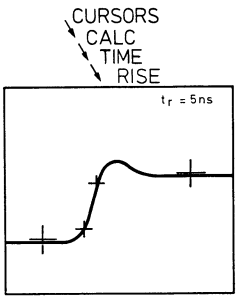
The RISE (or FALL) measurement is calculated between the MAIN CURSORS. It is necessary to set the main cursors on the signal, using the CURSOR-SELECT menu, and the signal part using the CURSOR-CONTROL menu.

By activating the RISE calculation function, the oscilloscope will automatically measure the rise-time of the first signal edge seen from the left cursor. The rise-time is determined on the nearest sample to the 10 % and the 90 % level of the amplitude between the MAIN CURSORS.

The measuring result is shown in the top text area.

RISE : tr = ... ns





4.3 CURSOR MEASUREMENTS

4.3.3 ZOOM AND AUTO ZOOM FUNCTIONS

The ZOOM and AUTO ZOOM functions are used to magnify a part of signal while retaining full sample resolution over the selected part.

ZOOM

If part of the signal needs to be examined in more detail the ZOOM function can be used. The main cursors can be set on the signal and the signal part of interest, using the CURSOR SELECT menu and the CURSOR CONTROL menu.

Then by entering the ZOOM menu and activating the RESTART function, if within the limits of time base and delay range, a new acquisition will be made in the adapted time base setting and delay time. This means that the the selected part is resampled using full memory and at a higher sample rate and so higher resolution only on the part of interest.

The REVERSE function resamples at the previous settings.

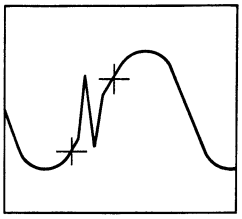
The CENTER function sets the MAIN CURSORS horizontally to +2 DIV and -2 DIV from the screen centre. This helps to continuously zoom in on the signal part of interest without having to return to the CURSOR CONTROL menu and then back to the ZOOM menu.

After which a new RESTART can be made.

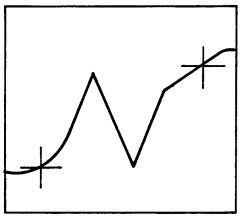
The limitations for the ZOOM function is given as an error message on the screen. The three possible limitations are:
- NO RESTART, timebase limit reached
- NO RESTART, trigger delay limit reached
- NO RESTART, Δt between cursors too big

The ZOOM mode is not active if the signal memory is locked. When locked, the following error message is shown on the screen:
- WARNING, oscilloscope is in lock mode

ZOOM



RESTART

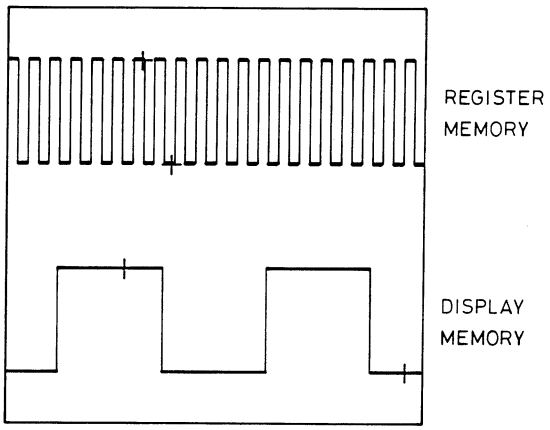


AUTO ZOOM

In this mode it is possible to simulate the operation of a delay time-base function by displaying a main time-base signal and a delayed time-base signal on the screen together.

The main time-base signal is stored in the REGISTER memory, simply load the signal to be examined into the REGISTER memory and display this on the screen. Move the live signal away from the stored signal by use of the channel position control.

When AUTO ZOOM is activated the MAIN CURSORS are set on the stored signal and the LOCATE CURSORS on the live signal. These cursors indicate the part of the signal that is displayed in more detail and can be shifted across the screen or the time-base can be expanded up or down by means of the softkeys. When the distance between the LOCATE CURSORS is less than 3 divisions or more than 9 divisions, then the time-base is automatically set to a more suitable setting. The result is that the live signal shows the adapted situation. This mode is not active if the signal memory is locked.


REGISTER
MEMORY
DISPLAY
MEMORY

This page intentionally left blank

5 PLOTTING AND PRINTING

5.1 INTRODUCTION

The oscilloscope has facilities to make a hard copy of the information on the CRT via a plotter or a printer. The plot out can consist of the recorded waveform(s), the belonging oscilloscope settings, the trace identification, cursors, measurements and a measuring graticule. Different options exist depending upon the version of the oscilloscope (indicated on type plate on rear panel).

- The standard or /00 version of the oscilloscope has no interface options installed. Consequently the plot out facilities are limited to analog plot out via an analog XY plotter.
- Version /40 has an IEEE-488 option installed. Plot out via a number of digital XY plotters (compatible with HPGL and PHILIPS GL) and via Epson FX-80 and compatible dot-matrix printers or HP Thinkjet (HP 2225) is possible if they are equipped with an IEEE-488 interface.
- Version /50 has an RS-232C option installeda. Plot out via a number of digital XY plotters (compatible with HPGL and PHILIPS GL) and via Epson FX-80 and compatible dot-matrix printers or HP Thinkjet (HP 2225) is possible if they are equipped with a RS-232C interface.

Before you are able to plot or print a hard copy of the information on the CRT it is necessary to make some preparations:
- Oscilloscope and printer/plotter must be interconnected via a suitable cable.
- The oscilloscope and the printer/plotter must be set up to the correct interface parameters.

All set up actions are done under the APPLication preselect menu which can be entered by pressing the front panel keys MENU and AUTO SET simultaneously. After this the APPL softkey must be pressed. Selected parameters are visible in the top text area of the CRT.

The plot action is started by pressing the front panel PLOT key. Please note that during the plot action the signal acquisition stops and all softkeys are inactive.

The following pages explain how to set up, for the analog plot out, the IEEE-488 interface and the RS-232C interface. Also the features and limitations are discussed. In order to make a correct set up possible it is necessary to have an operator's manual available of the plotter/printer that is to be connected to the oscilloscope.

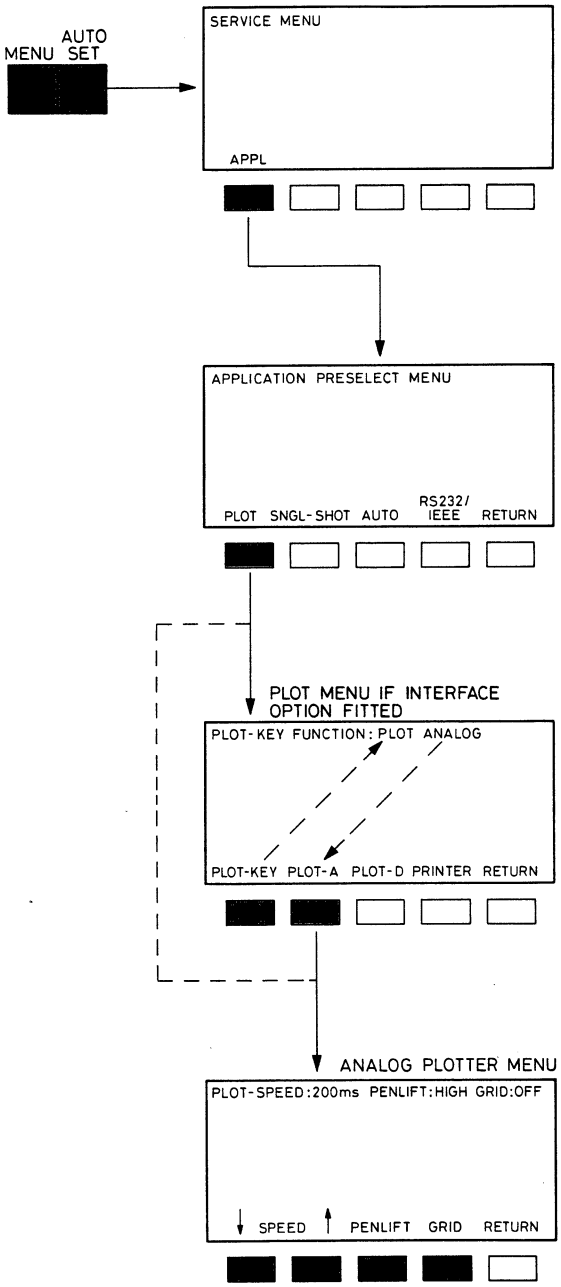
5.2 ANALOG PLOT OUT TO XY RECORDERS.

This mode is possible for all versions of the oscilloscope. The things that can be plotted out are the waveform(s), the channel identification on the CRT and the measuring graticule and can be used to make a hard copy of the screen information including all mentioned facilities. The set up is done as follows (selections marked with # are plotter dependent. Refer the operator's manual of the plotter):

- Enter the service menu by pressing the keys MENU and AUTO SET simultaneously and * becomes visible in the LCD.
- Press softkey APPL to enter the applications select menu.
- Press softkey PLOT.
- If present, press softkey PLOT-KEY until "plot analog" appears in the top text area of the CRT. This has the result that the analog plot action is started if the front panel key PLOT is pressed. (This is only necessary when the instrument is provided with an IEEE or RS-232 option).
- Press softkey PLOT-A: this gives access to the set up menu for the analog plot mode. Via this menu the PLOTSPEED (#, range 20 ... 2000 ms/dot) for slow-rate limitations and the PENLIFT (#, pen on paper at high or low level) can be adapted to the plotter. Moreover with GRID on, a graticule is plotted.
- Press front panel key AUTO SET in order to leave the service menu.

The plot out information becomes available at the 9 pin D-connector. This connector is at the rear of the oscilloscope. The output signal consists of X and Y deflection signals of 1V (100 mV/div) and the penlift signal at TTL level. For interconnection between oscilloscope and XY recorder two cable types are available. Both are equipped with a 9 pin connector that fits in the analog plot out connector of the oscilloscope. The connector on the other end depends on the type that is ordered:

- The PM9076/01 type has 6 banana plugs: black = neutral, red = Y-deflection, blue = X-deflection, green = pen lift.
- The PM9076/02 type has a 14 pole amphenol connector.



5.2 ANALOG PLOT OUT TO XY RECORDERS.

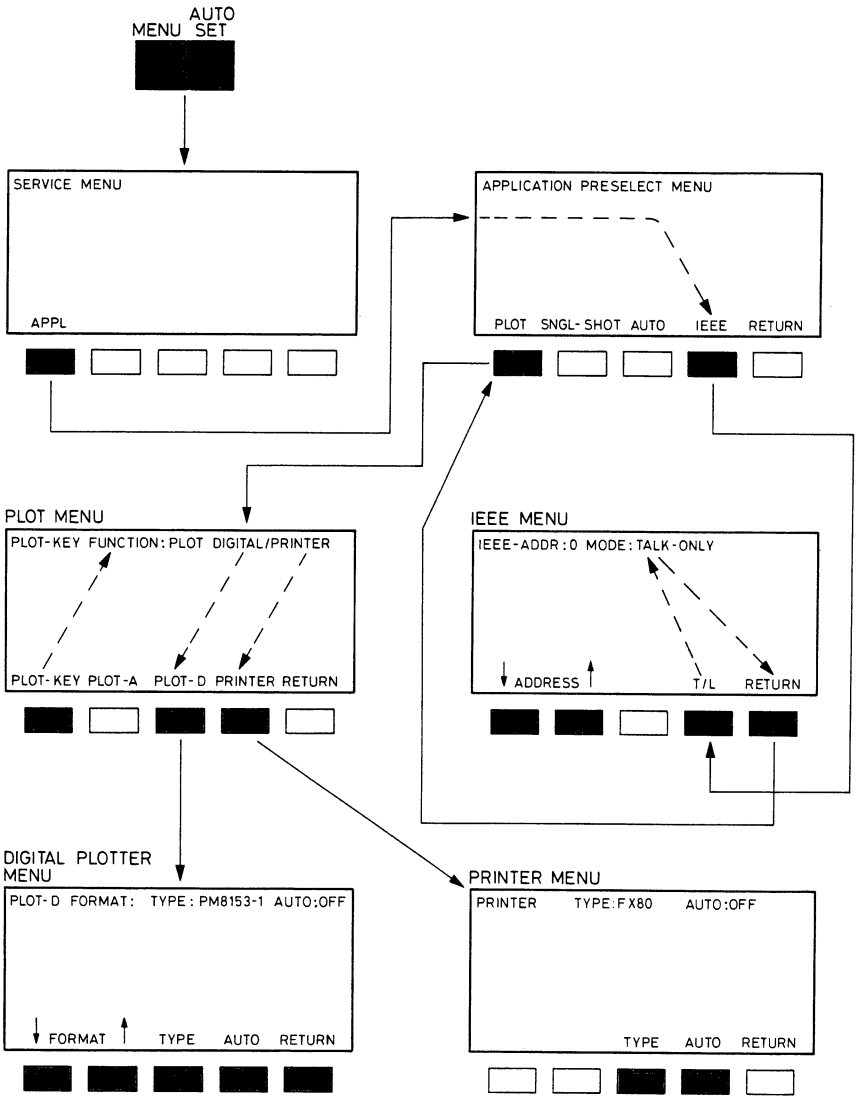
5.3 PLOT AND PRINT VIA IEEE-488 INTERFACE

This mode is only possible for the /40 version of the oscilloscope. All information on the screen will be plotted out or printed out: this includes the settings of the displayed traces. The set up is done as follows:
- Enter the service menu by pressing the keys MENU and AUTO SET simultaneously and * becomes visible on the LCD.
- Press softkey APPL to enter the application preselect menu.
- Press softkey IEEE to enter the IEEE set up menu.
- Press softkey RETURN.
- Press softkey PLOT.

From now on the set up procedure for digital plotter and printer is different; first the procedure for the digital XY plotter is explained:
- Select "plot-digital" in the top text area with softkey PLOT-KEY. This has the result that the digital plot action is started if the front panel key PLOT is pressed.
- Press softkey PLOT-D to enter the digital plotter menu.
- Select the plotter type with softkey TYPE; the selected plotter is indicated in the top text area.
  These types are: PM8153/1
  PM8153/6
  PM8154 (limited plot-size!)
  PM8155
  HP7475A (limited plot-size!)
  HP7550
- Select the format of the hard copy; can be choosen between 0,5x and 2x the screen size via softkey FORMAT.
- If you select AUTO:on, a hard copy is plotted after each single shot.
- Press front panel key AUTO SET once to return to normal oscilloscope use.

The procedure for the set up for the dot matrix printer is as follows:
- Select "printer" in the top text area with softkey PLOT-KEY. This has the result that the printer is started if the front panel key PLOT is pressed.
- Press softkey PRINTER to enter the printer menu.
- Select the printer type with softkey TYPE; the selected printer is indicated in the top text area of the CRT screen.
- If you select AUTO:on, a hard copy is printed after each single shot.
- Press front panel key AUTO SET once to exit the application preselect menu..

Philips offers three different cable types to connect the oscilloscope to the plotter or printer via the IEEE-488 bus:
- Type PM2295/05: cable length 0,5m.
- Type PM2295/10: cable length 1 m.
- Type PM2295/20: cable length 2 m.



5.3 PLOT AND PRINT VIA IEEE-488 INTERFACE

5.4 PLOT AND PRINT VIA RS-232C INTERFACE

This mode is only possible for the /50 version of the oscilloscope. All information on the screen will be plotted out or printed out; this includes the settings of the displayed traces. The set up is done as follows (selections marked with # are plotter/printer dependent. Refer to the operator's manual of the plotter/printer):

- Enter the service menu by pressing the keys MENU and AUTO SET simultaneously and * becomes visible on the LCD.
- Press softkey APPL to enter the application preselect menu.
- Press softkey RS232 to enter the RS-232C set up menu.
- Press softkey BAUDRATE and adjust the OUT-SPD (output speed) to the desired value (#).
- Press softkey RETURN.
- Press softkey DATA and adjust PARITY, STOP BIT and DATA BIT to the desired value (#).
- Press softkey RETURN twice.
- Press softkey PLOT to enter the PLOT menu.

From now on the set up procedure for digital plotter and printer is different; first the procedure for digital XY plotter is explained:

- Select "plot-digital" in the top text area with softkey PLOT-KEY. This has the result that the digital plot action is started if the front panel key PLOT is pressed.
- Press softkey PLOT-D to enter the digital plotter menu.
- Select the plotter type with softkey TYPE; the selected plotter is indicated in the top text area.
- Select the format of the hard copy; can be chosen between 0,5x and 2x the screen size via softkey FORMAT.
- If you select AUTO:on, a hard copy is plotted after each single shot.
- Press front panel key AUTO SET to exit the application preselect menu..

The procedure for the set up for the dot matrix printer is as follows:

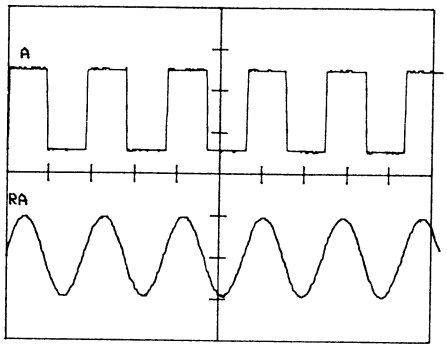
- Select "printer" in the top text area with softkey PLOT-KEY. This has the result that the printer is started if the front panel key PLOT is pressed.
- Press softkey PRINTER to enter the printer menu.
- Select the printer type with softkey TYPE; the selected printer is indicated in the top text area of the CRT screen.
- If you select AUTO:on, a hard copy is plotted out after each single shot and re-arming.
- Press front panel key AUTO SET to return to normal oscilloscope use.

The diagrams on the next page show the necessary interconnections between the oscilloscope and plotter.

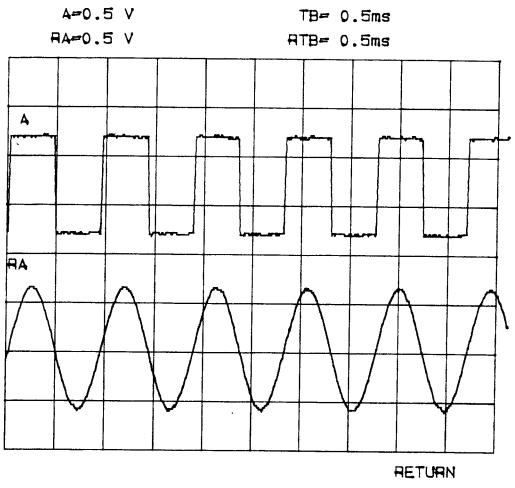
5.5 PLOTTING OR PRINTING RESULTS

This section shows examples of the three possible hard copy results, obtained with this oscilloscope.The three possibilities to make a hard copy of the screen are:

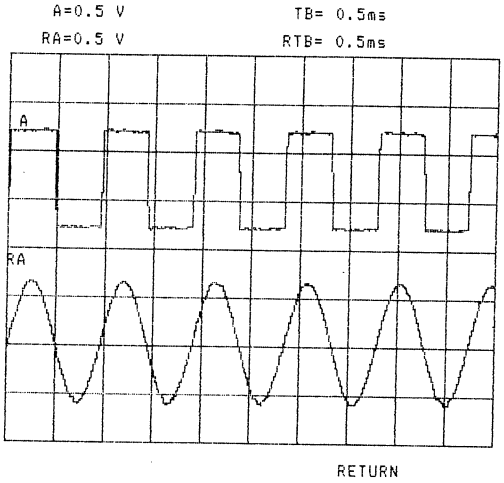
- plot-out with an analog X-Y recorder
- plot-out by a digital plotter
- print-out by a printer.



Example plot-out of an analog plotter



Example plot-out by a digital plotter



Plot-out of a printer

6 APPLICATION PRESELECT MENU

6.1 INTRODUCTION

The instrument offers the possibility to pre-select different applications by means of the APPLICATIONS PRESELECT menu. The applications are:
- PLOTTER/PRINTER definitions
- Single shot
- TV triggering after AUTO SET
- IEEE-488 definitions (optional)
- RS-232C definitions (optional)

To enter the main-menu, proceed as follows:
- Press MENU and keep it pressed.
- Press also AUTO SET.
- Now the Service menu has been entered, the LCD should indicate "*".
- Press APPL, which is one of the CRT softkeys.
- The CRT should indicate "APPLICATION PRESELECT MENU" on the upper side of the screen.

Having entered this menu, the lower level can be chosen by means of one of the four CRT softkeys.

6.2 ANALOG PLOT

Selected by pressing CRT softkey PLOT (or PLOT-A if option has been installed).
You can define the plot speed, penlift and grid of the ANALOG PLOT.
PLOT speed : between 20 ms ... 2000 ms in a 20 or 100 step sequence
PENLIFT level: active high or active low.
GRID: plotting or not plotting a grid.

ATTENTION: When an IEEE or RS232 option is installed, the PLOT menu gives first a selection between analog plot, digital plot and printer.

6.3 DIGITAL PLOT

Selected by pressing CRT softkey PLOT-D.
You can define the plotter format, type of plotter and auto plot.
FORMAT:O,5 * normal screen ... 2 * normal screen
TYPE: PM8153/1, PM8153/6, PM8154, PM8155, HP7475A and HP7550
AUTO: ON for a plot after each single-shot and re-arming.
OFF for a plot after pressing the PLOT key.

6.4 PRINT

Selected by pressing PRINTER.
You can define the auto mode,
AUTO: ON for a print after each single-shot and re-arming.
OFF for a print after pressing the PLOT key,

6.5 SINGLE SHOT

Selected by pressing CRT softkey SNGL-SHOT.
In analog single-shot mode you can define the single shot sequence when the instrument is in alternated mode.
FIRST: single-shot is always done on channel A (provided it is active).
MULTI: single shot is done alternated between channel A, B and ADD (provided these are active).

6.6 TV TRIGGERING AFTER AUTO SET

Selected by pressing CRT softkey AUTO.
You can define the TV trigger coupling mode after an AUTO SET.
TVF: trigger coupling is forced to TV FRAME mode.
TFV/TVL: trigger coupling returns to the previous mode TV FRAME or TV LINE.

6.7 IEEE-488 (optional)

Selected by pressing CRT softkey IEEE.
You can define the IEEE address and the IEEE mode.
ADDRESS: between 0 ... 30 (default address: 8)
MODE: talk only, listen only and talker/listener

6.8 RS-232C (optional)

Selected by pressing CRT softkey RS232.
You can define the baudrates and the RS232 data.

OUTPUT SPEED: between 75 ... 19200 bits/sec
INPUT SPEED: between 75 ... 1200 bits/sec
PARITY: parity is EVEN, ODD or NO
STOP BIT: 1 or 2
DATA BIT: 7 or 8

Index

A

A/B key, 4-2

AC/DC key, 4-2

ADD/INVERT key, 4-6

ALT/CHOP key, 4-6

AMPLITUDE MEASUREMENTS, 4-38

ANALOG OSCILLOSCOPE, 4-1/...17

ANALOG PLOT, 6-1

ANALOG PLOT OUT, i-vi, 3-10, 5-2/...3

APPLICATION PRESELECT MENU, 4-10, 6-1/...2

APPLICATIONS, 4-1/...49

AUTO, 4-24

AUTO SET key, 3-1, 4-1, 4-18

AUTOZOOM, 4-37, 4-48

C

Cable configuration, 5-8

CAL, i-vi

CAL OUT, 3-10

CAL OUTPUT, 3-1

CALCULATE MENU, 4-34

CALCULATE-AMPLITUDE MENU, 4-35

CATHODE RAY TUBE, 3-3

CONTROL MENU, 4-33

CRT SCREEN, 3-3

CURSOR MEASUREMENTS, 4-32/...49

CURSOR MENU, 4-33

CURSORS MENU, 4-32

D

DIGITAL MEMORY key, 4-1, 4-18

DIGITAL OSCILLOSCOPE, 4-18/...31

DIGITAL PLOT, 6-1

DISPL PART UP-DOWN key, 4-22

DISPLAY key, 4-20

DISPLAY MEMORY, 4-20

DISPLAY PART, 3-4

DOTS key, 4-18

E

EARTHING, 2-1

F

FRONT PANEL, i-vi

FRONTPANEL LAY OUT, 3-2/...12

FUNCTION KEYS, 3-5

FUSES, 2-1

G

GND key, 4-2

H

HANDLE ADJUSTMENT, 2-3

HOLD-OFF, 4-16

HORIZONTAL MODE, 4-8, 4-22

HORIZONTAL RESOLUTION, 4-18

I

IEEE BUS OPTION, i-vi

IEEE-488 BUS, 3-11, 6-2

ILLUMINATION rotary knob, 3-2

INPUTS AND OUTPUTS, 3-10

INTENS rotary knob, 3-2

L

LCD, 3-3

LEVEL VIEW key, 4-14

LINE IN, i-vi, 3-10
LOAD key, 4-20

M

MAIN MENU, 4-32
MAINS VOLTAGE CORD, 2-1
MEMORY BACK-UP, 2-2
MULTIPLE SHOT, 4-24, 4-28

P

PLOT AND PRINT, 5-4/...8
PLOTTING, 5-1/...10
PRINTING, 5-1/...10, 6-2

R

RACKMOUNT, 2-3/...4
REAR PANEL, i-vi
RECURRENT MODE, 4-22
REGISTER MEMORY, 4-20
RESET key, 4-26
ROLL MODE, 4-22, 4-24
ROTARY KNOBS, 3-8
RS-232C, 6-2
RS-232C BUS, 3-11
RS232 BUS OPTION, i-vi

S

SAFETY INSTRUCTIONS, 2-1
SAFETY PRECAUTIONS, 1-1
SAMPLING MODE, 4-22, 4-24
SCREEN CONTROLS, 3-2
SELECT MENU, 4-33
SETTINGS MENU, 4-32
SHIFT MENU, 4-32
SINGLE SHOT, 4-24, 4-26, 6-2
SLOPE key, 4-16
SOFTKEYS, 3-8
STATUS key, 4-20

T

TB MAGN key, 4-8, 4-22
TB s...us UP-DOWN key, 4-8, 4-22
TB TRIG MODE key, 4-10, 4-26, 4-28
TIME MEASUREMENTS, 4-42
TRACE ROTATION, 3-2
TRIG, 4-24
TRIG COUPL key, 4-14
TRIG DEL UP-DOWN key, 4-30
TRIG LEVEL, 4-14
TRIG OR X SOURCE key, 4-8, 4-12
TRIGGER DELAY, 3-4, 4-24, 4-30
TRIGGER MODE, 4-1, 4-10, 4-26
TV TRIGGERING, 4-14, 6-2

U

UP-DOWN KEYS, 3-4

V

V...mV UP-DOWN key, 4-4
VERTICAL MODE, 4-2, 4-18
VERTICAL RESOLUTION, 4-18
VIEWING AREA, 3-3

X

X DEFL key, 4-8

Z

Z-MOD, i-vi, 3-11
ZOOM, 4-46
ZOOM MENU, 4-37